VOLUME V SEPTEMBER, 1914 NUMBER 7

THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

MINOR STUDIES IN LEARNING AND RELEARNING.[1]

DAVID SPENCE HILL, PH.D.,

Department of Educational Research, Public Schools, New Orleans.

Experience as a teacher of educational psychology has left the writer with considerable unfinished data collected both in the class room or laboratory, and also in private study. The following brief account of experiments is offered as representing some difficulties and experimental methods of interest to practical instructors of elementary classes in educational psychology. The first series is descriptive of material for and uses of mirror drawing; the second series concerns an attempt to apply the method of equal groups in the use of substitution tests; and the third experiment includes the construction and use of new material for the cancellation or A test found serviceable for class experimentation.

(1) MIRROR DRAWING. (a) *The problem of neuro-muscular memory;* (b) *Transfer effect as regulated by slightly altered objective elements.*

(a) During 1911 the writer reported tentatively upon a study of mirror drawing undertaken by one subject during October, November and December of 1910. (*Psychological Bulletin*, Vol. VIII, No. 1.) The trials, one a day, were continued through about fifty days. Since December 1910 the subject has done no mirror-drawing. In the *Psychological Bulletin* for January, 1910, there are contained two articles, one by Swift on "Relearning a Skillful Act," and another by

[1]Read before Section H of the American Association for the Advancement of Science, Atlanta, Ga., January 1, 1914.

Starch on "A Demonstration of the Trial and Error Method of Learning" (mirror drawing). Swift used the learning of tossing two balls with one hand, but the two articles suggested to the writer the application of mirror drawing to the problem of relearning and a comparison of results with those of Swift on relearning a skillful act.

The materials used were the figure with semi-circles and the star which were printed from zinc etchings for the writer in Nashville, Tenn., as previously described. The designs are here shown. Figure I.

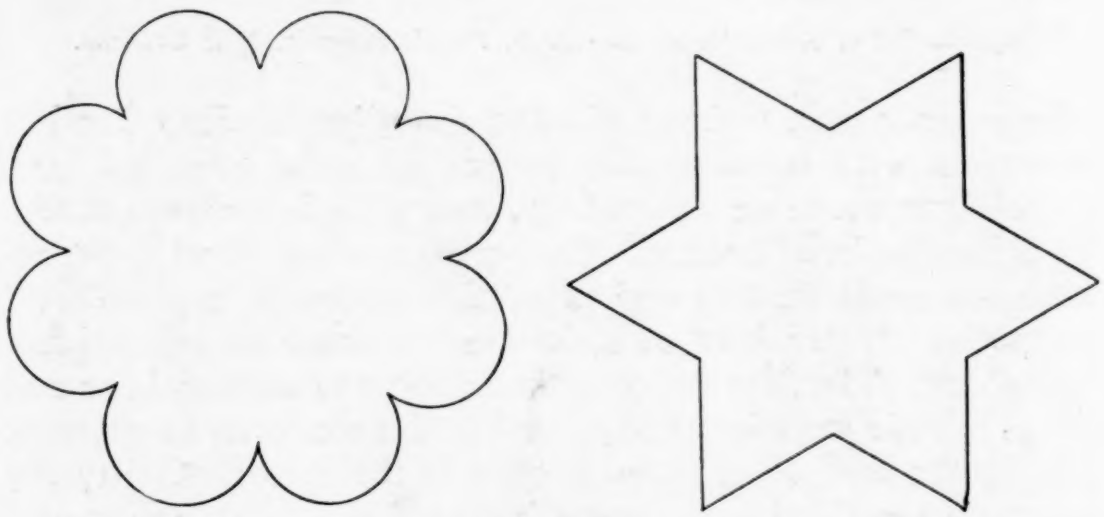

FIGURE I.

Nearly three years to a day after the first series the subject, J. P. H., has completed (December 16, 1913) eight daily trials as before in 1910, when the practice or daily trials amounted to 48. A comparison of the progress curves, both for speed and accuracy, for 1910 and for 1913 indicates that in about three or four daily trials in 1913 the subject had attained her standard of 1910—that, in fact, at the beginning of the 1913 experiment her status was not considerably below that of 1910—the speed slightly less, the accuracy a fraction more. The curves are seen in Figure II. The curve for 48 days is markedly like that of Starch, and exhibits the usual daily variations. The figures (neglecting fractions of seconds) for time and errors for all of the practice series are shown in Table I.

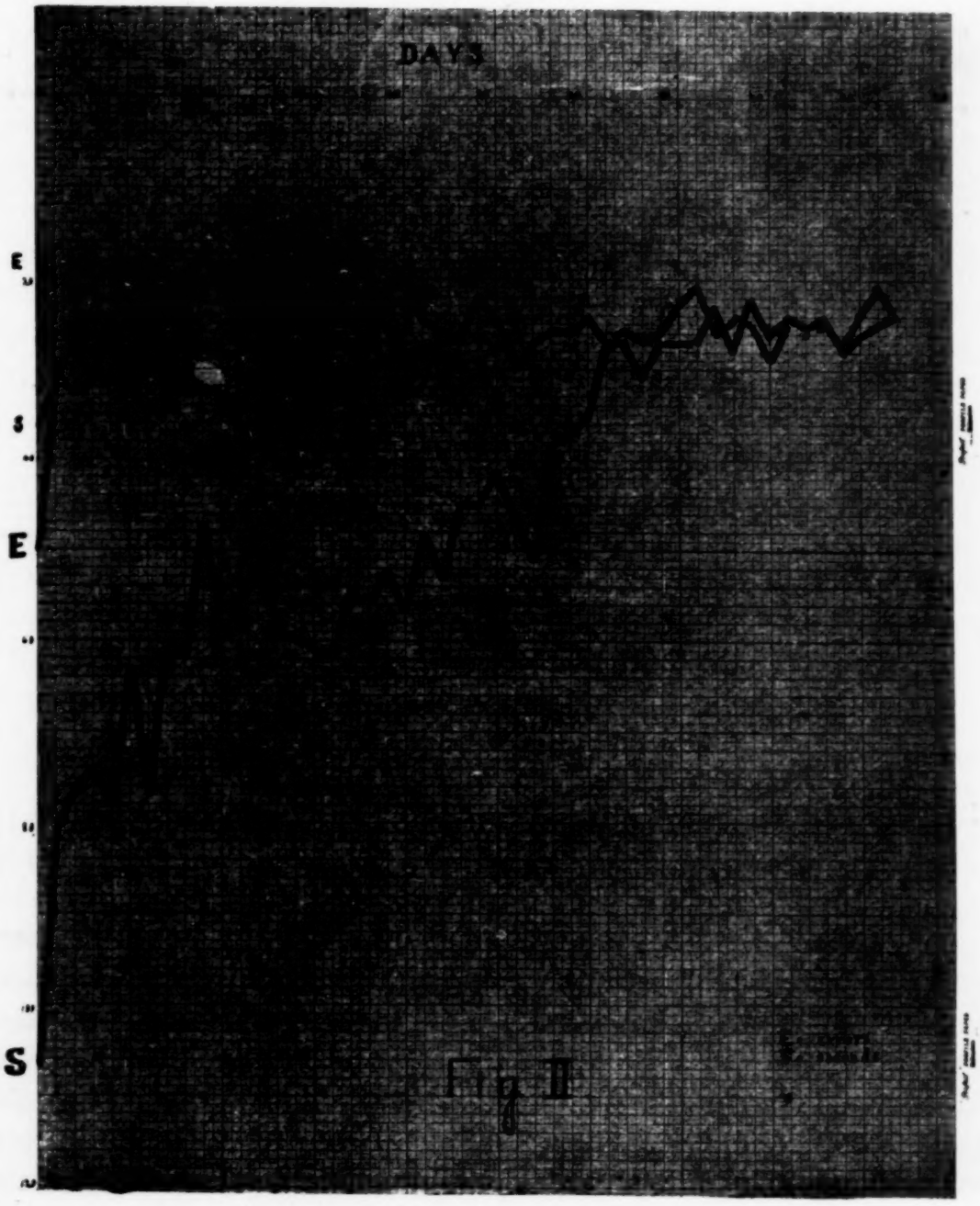
DAYS
E
S
E
S

TABLE I.

SPEED AND ACCURACY: STARS TRACED WITH RIGHT HAND IN MIRROR DRAWING.

Series 1910.

Trial.	Date.	Seconds.	Errors.	Trial.	Date.	Seconds.	Errors.
1	Oct. 29	107	50	25	Nov. 25	45	22
2	30	81	31	26	27	41	25
3	31	76	33	27	28	46	30
4	Nov. 1	74	32	28	29	51	27
5	2	78	25	29	30	38	26
6	4	63	30	30	Dec. 1	37	26
7	5	77	28	31	2	35	24
8	6	60	25	32	3	27	27
9	7	62	25	33	4	27	26
10	8	47	17	34	5	31	27
11	9	60	22	35	6	27	26
12	10	55	26	36	7	?	23
13	12	53	29	37	8	27	21
14	13	59	30	38	9	23	26
15	14	60	28	39	10	28	24
16	15	61	27	40	11	22	25
17	17	62	25	41	12	26	29
18	18	55	25	42	13	24	24
19	19	56	27	43	14	25	25
20	20	52	21	44	16	24	25
21	21	57	21	45	17	28	28
22	22	48	25	46	18	26	24
23	23	53	26	47	19	25	21
24	24	45	27	48	20	24	24

Series 1913.

Trial.	Date.	Seconds.	Errors.	Trial.	Date.	Seconds.	Errors.
1	Dec. 8	36	18	5	Dec. 12	23	19
2	9	32	21	6	13	24	22
3	10	27	22	7	14	26	19
4	11	24	21	8	15	26	19

More than six years intervened between the beginning and end of Swift's tests—interrupted, however, by several "memory" tests in the interim. His original curve of learning does not show the rapid increase during first trials characteristic of ours. It required eleven days for him to regain the skill which in the earlier work had required forty-two days of practice, and the curves suggest that evidently between his first and last series much of the acquired skill had been lost. However, Thorndike in reviewing the experiment points out that, although the impression is given here that the time required for relearning was about one-fourth as long, the actual time required, up to and including the tenth day, was, in fact, al-

most a third as long as the time required to reach an equal ability in the original. Says he, "The eleven days as a whole involved over four-tenths as many tosses as the entire original fifty-two days of practice. The suggestion or conclusion of Swift that 'evidently the mind continues its activity for a time in the furtherance of a learning process after practice and study have ceased' is met by the assertion of Thorndike that 'This may be true, but nothing in the measurements of the permanence of skill in tossing balls gives proof of it.' " [Psychology of Learning, Vol. II, p. 314.]

In our experiments with the mirror-drawing little of the previously-acquired skill had been lost in the interim. There was little relearning to be accomplished, little had been forgotten, and it appears that after the warming-up the lost associations were quickly recovered. Our observations of the work of hundreds of trials of mirror-drawing lead to the opinion that there is very little of the trial and error method used in mirror-drawing after the first two or three trials. This accounts, in part, for the initial rapid improvement. Reasoning and even imitation of the attitude and movements of other experimenters very soon intervene. It is the usual happening for certain kinaesthetic sensations to appear plain, and these become associated with perceptions of direction and form and time. It is the recollection of these complexes which constitute relearning of the act, modified by changes in maturity and in attitude of the subject at the time. These complexes of association constitute the fabric of the neuro-muscular memory; and their impression, retention and recall may not be different from the usual aspects of the memory consciousness. In contrasting the first and last curves one must allow for possible ennui in the latter part of the first and for renewed zest, curiosity or interest in the matter of relearning. The performance seems no more remarkable than the instantaneous picking-up of a neglected tune by an old pianist after years of indifference and forgetfulness. Aside from the danger of generalizing from an individual case we cannot see in this case any safe ground for assuming that "the mind continues its activity for a time in the furtherance of a learning process after practice and study have ceased." The problems

of the neuro-muscular memory involved in the case seem to be the problems of the memory aspects of consciousness in general.

It is realized, of course, that three years' disuse in mirror-drawing might produce very different relearning curves from the same disuse of typewriting, ball-tossing, learning poetry or syllables. Thorndike notes the possible advantage in permanence of functions, whose improvement consists in reproducing better by movement of the muscles to some sense presentations, over functions where "surety and speed of bonds from one internally initiated event in the brain to another are the main facts to be improved" (Vol. II, Educational Psychology, p. 326). The contrast is illustrated by skating, dancing, swimming, on the one hand; knowledge of chemistry, geology or the recital of poems or nonsense series, on the other. In this connection the writer desires to add that the same subject, J. P. H., during 1910 was tested during the period November 21 to December 5 for passive touch discrimination by the use of a modified Binet esthesiometer. Some sixty trials at each sitting were given, points at fixed distances being used. It is our intention shortly to test in the same person a relearning after four years of the ability to discriminate one from two points, an experiment which may prove to be of interest in view of the above hypothesis of Thorndike concerning the superiority of sensori-motor functions for permanence.

(b) *Transfer effect as regulated by slightly-altered objective elements.*

In the consideration of the spread of skill as an effect of special practice, the matter of the common element inherent in the reaction of an individual to a situation is important. If we assume that, on the one hand, spread from one situation to another is conditioned upon the coincidence of cerebral and muscular elements, the objective character of the stimuli, on the other hand, permits by manipulation many changes in bringing into action elements of two nearly identical situations. In mirror-drawing, in which it is known that the transfer effect from right to left hand is large, it is possible to

demonstrate nicely the regulation of transfer effect by a slight alteration of the external factors. This has been done by noting in this experiment the amounts of "transfer" of the skill acquired in tracing stars by mirror-drawing, and in the drawing of slightly-dissimilar figures (connected semi-circles), both from the left and from the right hand.

In the year 1910, and also in the series of 1913, the subject made initial and terminal tests with right and left hands, drawing both stars and semicircles; the tests in both series were made both before and after the regular practice series of Table I above. In the summary, Table II, it is seen in the terminal tests of December 20, 1910 (1) that for both hands the improvement was greater for *stars* (identical designs) than for *semi-circles* (slightly different); (2) that improvement ("transfer") in the unpracticed left hand is less than that for the right for stars; (3) that the skill in producing the dissimilar figures (semi-circles) remains almost the same in both hands, with an advantage to the left.

After the conclusion of the practice series of December, 1913, the terminal tests of December, 1910, were repeated, with the results also shown in Table II. Comparison of the finals of 1913 with the finals of 1910 reveal the following: The practice designs (stars) show gains over 1910, with some advantage in the unpracticed left hand. The unpracticed designs (semi-circles) show marked losses, but with a 20 per cent. gain in accuracy in one instance. It would seem that the losses of the unpracticed semi-circles may be due partly to interference of associations with the more deeply established connections for the other (star) design, as well as simply to the lack of permanence of the others since 1910, due to lack of practice. For demonstrating the regulation of transfer effect by the substitution of the semi-circles for the star, the results of the practiced right hand are sufficient. The data from the left hand are complicated by the conditions of cross-transfer, general awkwardness, etc. All of the terminal tests are, of course, in a measure affected by practice in the initial test.

Altogether, in addition to the uses of mirror-drawing pointed out by Downey, Dearborn, Starch, Burt and others,

TABLE II.

INITIAL TESTS, OCT., 1910, AND TERMINAL TESTS, DEC., 1910, AND DEC., 1913.

Date.	Hand.	Design.	Seconds.	Errors.	Remarks.
Oct. 29, 1910	R	Star	107	50	Unpracticed.
Oct. 29, 1910	R	S. Circles	115	60	Unpracticed.
Oct. 29, 1910	L	Star	104	64	Unpracticed.
Oct. 29, 1910	L	S. Circles	118	71	Unpracticed.
Dec. 20, 1910	R	Star	24	24	Practiced.
Dec. 20, 1910	R	S. Circles	42	50	Unpracticed.
Dec. 20, 1910	L	Star	32	40	Unpracticed.
Dec. 20, 1910	L	S. Circles	44	52	Unpracticed.
Dec. 16, 1913	R	Star	22	15	
Dec. 16, 1913	R	S. Circles	55	58	
Dec. 16, 1913	L	Star	27	21	
Dec. 16, 1913	L	S. Circles	58	41	

Percentages gain Oct. 29, 1910, to Dec. 20, 1910.

Time.	Accuracy.	Av.
78	52	65
63	17	40
69	38	54
63	27	45

Dec. 20, 1910, to Dec. 16, 1913.

Time.	Accuracy.	Av.
8	38	23
—31	—16	—24
16	48	32
—32	21	—6

the repetition of this experiment upon a group of individuals offers interesting possibilities in analyzing out for class discussion some of the elements of transferred learning, whether it be due to unknown factors, to interferences, partial practice in terminal and initial tests, identical elements or to an altered external factor, as in the case of our semi-circles.

2. Class Experiment on Periods of Learning by Use of Substitution Tests.

A group of ten students, chiefly teachers, practiced for twelve days the formation of new associations between letters and numbers, using as material the blanks in Starch's book. (*Experiments in Educational Psychology*). The task is to substitute for the letters in the reading matter the appropriate figures or numbers according to the prearranged key. An initial test was also given on different material where geometrical designs were used to be substituted for numbers, and at the end of the practice series a terminal test was made, using material similar to, but not identical with, the initial test. In the initial and terminal tests time was recorded in seconds for the completion of a page; the number of substitutions during a given time was recorded in the practice series.

It was proposed at the outset of the experiment to divide the class into two approximately equal groups upon the basis of the performance of the initial test (geometrical designs—numbers). A consideration of the rank of the subjects in Table III shows that there was small correlation between the initial and the first practice (letters—numbers) trials. The table shows the rank of the subjects with regard to: (1) Initial test (geometrical designs—numbers); (2) First ten minutes of practice tests (letters—numbers); (3) Improvement by practice; (4) Improvement in terminal, or "transfer," test without practice. (Table III.)

TABLE III.

Individual.	Initial Test.		Ten Minutes of First Practice.		Improvement by Practice.		Improvement on Terminal Test.	
	Sec.	Rank.	Substitutions.	Rank.	Per cent.	Rank.	Per cent	Rank.
A.....	119	1	266	1	138	9	24	1
B.....	114	2	157	7	158	7	21	2
C.....	112	3	167	6	231	3	20	3
D.....	111	4	108	10	240	2	12	8
E.....	111	5	187	4	204	5	17	5
F.....	110	6	157	8	182	6	17	6
G.....	109	7	179	5	42	10	20	4
H.....	107	8	146	9	227	4	5	9
I.....	98	9	216	3	142	8	16	7
J.....	85	10	225	2	269	1	— 1	10

The class was divided into two groups, upon the basis of performance of the first practice results. Group I worked ten minutes per day. Group II twenty minutes every other day. Total time for both groups, two hours. The figures show that with one exception (G), all of the subjects of Group I, working ten minutes per day, gained a larger percentage than any of those working twenty minutes on alternate days. The improvement in the terminal tests of the twenty-minute series shows a tendency to excess over that of the ten-minute series, although our small numbers restrict inferences. (Table IV.)

TABLE IV.

Individual.	Substitution.	Per cent. improvement.	Per cent. transfer.
Group I.			
J	225	269	— 1
D	108	240	12
C	167	231	20
H	146	227	5
G	179	42	20
Group II.			
I	216	142	16
F	157	182	17
E	187	204	17
B	157	158	21
A	266	138	24

However similar objectively the work of the initial and of the practice series may seem to be at the outset, it is evident in attempting to divide a class into equal groups by the criteria of equal performances that it should not be done upon the basis of reactions that are of seemingly slightly different

character from the practice material. It is possible from our data to select two approximately equal, although small, groups, and the final results will not contradict the conclusion that frequent short periods of work are more economical for acquisition of skill than half as many longer periods distributed throughout a number of days. This conclusion would be worthless, however, not only because of the smallness of the groups, but also because the groups were not assuredly equal at the outset for the practice task in hand.

A further question suggested by this class experiment is an important one in its ultimate pedagogical bearings: What is the relation that the amount of transfer or general effect (spread) of learning bears to the different intervals of learning? To know how the *general* effect of a practice may be increased is as important as to record mere increase in speed and accuracy of acquisition of a special skill.

3. Cancellation Tests: New Material and an Experiment.

Our object here is to call attention to a convenient form for the cancellation or A-test, suitable alike for group or individual tests, and to describe a group test upon the effect of practice in marking A's, and upon the transfer of the improvement to marking words containing e and r. A short horizontal stroke was used in the marking.

In constructing the cancellation sheet it is believed that the following method of distribution is preferable to that of mixing type by the printer. Twenty-six marbles, each marked with a letter of the alphabet, were shaken in a small basket, and thereupon a marble was withdrawn. After the letter was written down, another mixing and withdrawal was made, and finally the MS. thus constructed was printed in linotype. A set of the forms beginning H D was printed on sheet of paper 5½x18 inches. Another set beginning with H J was made by simply transposing the order of linotype lines. Counting the A's in both sheets shows a uniform distribution, there being about fifteen A's to every ten lines. The chance order was adhered to in the printing, save where three A's were found grouped. This method of distributing the twenty-six letters, although laborious, secures for practical purposes one hundred alphabets, arranged in chance order.

A corresponding sheet for words was made by linotyping solidly, without paragraphs, some inches of Cicero's orations in Latin.

The effect of practice in marking A's. Twelve young women, college students at the Callender Laboratory, Newcomb College, Tulane University, under the writer's direction, marked A's upon two sheets for two minues per day at the same hour for fourteen days. How much the learning curve is modified by the fact that sheets (H D and H J) reoccur at intervals is not known. Practically all continued the work without interruption from November 21 to December 5. Average concellations of A's for the group are, omitting fractions:

TABLE V.

CANCELLATIONS OF "A."—TWELVE PERSONS.

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Average ..	37	40	41	42	44	46	46	45	49	49	51	55	55	58
M. V.....	8.1	7.7	8.3	8.4	9.5	7.9	9.2	11.9	8.5	9.5	9.7	8.1	7.6	9.1

The mean variations with these averages denote the range of individual performances during the successive days. In the complete series two students among the twelve missed two and three trials, respectively.

Improvement in marking words containing e and r. Before and after the practice series each subject marked the words containing e and r for two minutes as initial and terminal tests. The averages for the group were, for cancellations or speed, respectively: in the initial e-r test, 49, M.V. 5.3; in the terminal e-r test, 58.7, M.V. 6.5.

The averages for errors were: initial test, 4.7, M.V. 2.2; terminal test, 5.3, M.V. 2.7. The improvement in speed for the e-r tests was 20 per cent., which is about one-third as much as the improvement in marking A's (57 per cent.). Since the same Latin text was used for initial and terminal tests, it would seem that the actual net transfer was less than this amount. Only by a control group under identical conditions could the effect of one repetition of the initial test be estimated.

THE EFFECT OF PRACTICE UPON VISUAL APPREHENSION IN SCHOOL CHILDREN. PART II.

KARL M. DALLENBACH,

University of Oregon.

(*Studies from the Cornell Educational Laboratory, No.* 19.)

[Continued from the June JOURNAL.]

VII. RESULTS.

1. *Effect of practice in general:* Table I gives the subjects, the classification according to the results of the fore-practice, the results of the fore-practice, of the test series, and of the drill series, the class standing, and the age of each subject.

Tables II and III, which follow, give the composite results for the Test-Series and the Drill-Series, respectively. These tables are not constructed from the data in Table I, *i. e.,* they are *not the averages of averages,* but are compiled directly from the original data.

Table II shows the averages of the *Test-Series* for the three classes of subjects (the good, the medium, and the poor), the general average of the entire class, and the averages for the girls and the boys.

Table III shows the averages of the *Drill-Series* for the three classes of observers, the general averages of the entire class, the average of the girls and the boys, also the average age for each class of subjects, and the average age of the class as a whole.

These Tables and Curves show the effect of practice upon visualization. When the total results are considered alone, they agree very closely with those of Whipple and Foster, and the other investigators upon the problem of practice. There was a very appreciable gain in the efficiency of the subjects' reports during the course of the experiment. This improvement was very large at first and small in the later part of the work. In the Test-Series (Table II; also Plate III) the in-

TABLE I.

Classification, Net Average Scores by Periods, School Standing, and Average Age of Each Pupil.

	Pupil.	Av. of Fore-Practice, 1st Wk.	Av. of Test-Series A, 2d Wk.	Av. of Drill-Series 1, 3d-6th Wk.	Av. of Test-Series B, 7th Wk.	Av. of Drill-Series 2, 8th-11th Wk.	Av. of Test-Series C, 12th Wk.	Av. of Drill-Series 3, 13th-16th Wk.	Av. of Test-Series D, 17th Wk.	Av. of Test-Series E, 58th Wk.	School Standing.	Age.*
Class I	Lloyd	46.6	43.5	54.2	52.4	63.0	53.2	55.3	44.6	53.3	A	7 : 9
	Lura	45.0	40.0	51.0	40.6	55.6	54.3	59.1	52.3	...	A	8 : 6
	Ezra	44.9	40.7	48.1	45.5	52.9	44.5	50.0	42.9	...	B	8 : 6
	Raul	44.7	44.6	60.3	53.3	63.4	54.6	71.7	55.0	...	A	9 : 6
	Edward B.	44.1	36.6	49.7	51.4	53.7	49.3	53.5	55.4	53.1	A	7 : 10
	Reginald	42.3	39.1	45.8	45.1	55.4	41.0	50.3	43.5	49.5	A	9 : 3
	Ethel	42.0	42.1	48.3	51.6	56.2	48.2	56.4	47.9	55.7	A	10 : 0
	Frank	40.7	29.1	42.2	43.8	50.3	44.5	46.2	49.5	51.9	B	8 : 3
	Sylvia	38.6	35.8	45.5	42.8	48.3	45.7	49.5	48.2	50.8	A	8 : 5
	Paul	38.3	34.8	47.4	45.6	56.1	50.0	54.1	47.4	...	A	8 : 6
Class II	Dorothy	37.5	37.0	44.0	47.8	50.0	47.6	49.5	46.6	50.0	B	8 : 3
	Clarence	37.0	32.0	44.0	37.5	41.9	40.0	40.3	39.5	42.3	B	9 : 2
	Lindsay	36.5	39.0	45.5	41.0	50.2	46.0	53.8	52.0	48.1	A	7 : 5
	John Cn.	36.4	31.6	42.0	45.2	51.5	48.6	48.5	44.9	51.9	A	7 : 10
	Carl	36.0	32.0	44.4	45.1	50.5	43.8	52.2	43.6	47.5	A	10 : 9
	Eileen	34.5	30.6	38.5	36.8	41.6	38.4	43.8	38.8	42.0	A	8 : 11
	Levena	34.1	32.2	39.8	42.0	50.7	42.0	50.4	48.5	...	B	6 : 6
	Truman	34.0	25.6	45.6	47.5	54.7	44.1	57.0	45.1	44.3	A	9 : 10
	Wilkenson	33.7	26.2	38.8	36.0	38.0	38.2	35.5	37.7	37.7	A	8 : 1
	Bernice	33.5	36.0	43.7	44.0	46.5	42.2	43.6	41.9	48.5	B	8 : 8
Class III	Chester	32.8	35.5	36.5	36.0	43.0	45.5	40.7	44.5	47.0	A	9 : 1
	Margaret	29.8	29.0	39.1	37.5	40.8	44.1	51.8	42.4	...	B	7 : 6
	Edward D.	29.8	29.2	44.6	43.3	46.5	43.3	51.5	45.3	45.4	A	9 : 1
	Francis	29.5	32.7	40.5	38.7	39.9	43.0	41.0	41.1	44.6	B	7 : 11
	John Cy.	28.9	33.4	44.4	42.2	51.1	40.3	43.0	41.5	...	B	7 : 6
	Evert	28.4	30.6	43.5	42.5	42.5	42.1	51.3	47.3	...	B	6 : 6
	Mercedes	26.6	29.1	34.2	33.5	35.9	39.4	39.2	46.1	48.4	B	7 : 7
	Helen	25.8	28.3	39.6	40.8	42.9	36.0	38.8	40.5	...	A	6 : 6
	Harry	25.5	27.0	40.5	38.5	46.8	40.0	52.1	42.1	...	B	9 : 0

*Age in years and months at beginning of experiment.

TABLE II.

Average Scores in the Test-Series.

Class.	Main Experiment. Series A, 2d Week.	Series B, 7th Week.	Series C, 12th Week.	Series D, 17th Week.	Re-test. Series E, 58th Week.
I.....	38.662	48.256	48.108	48.243	52.400
II.....	32.266	43.166	43.400	42.650	45.700
III.....	30.441	39.455	41.176	43.014	46.350
Total*.....	33.995	43.782	44.376	44.856	48.000
Girls.....	33.392	41.357	42.595	43.452	48.571
Boys.....	34.423	45.536	45.644	45.855	47.666

*The totals in this and the following tables are not averages of averages, but final averages from all the data.

TABLE III.

Average Scores in the Drill-Series.

Class.	*Av. Age.	Drill-Series 1.	Drill-Series 2.	Drill-Series 3.
I.....	8.65	49.059	56.046	54.276
II.....	8.54	42.737	47.852	47.618
III.....	7.83	40.423	43.839	44.325
Total.....	8.36	43.882	49.137	48.988
Girls.....	8.07	41.989	46.746	47.184
Boys.....	8.54	44.885	50.719	50.299

*Average age given in years and fraction of years.

crease between *Series A* and *Series B* was about ten units, between *Series B* and *Series C*, 0.6 of a unit, and between *Series C* and *Series D* only 0.5 of a unit. In the Drill-Series (Table III) there is actually a loss after the initial improvement. This loss is slight, however, 0.2 of a unit, and it can be explained by the fact that more difficult series were given to the subjects during this period than during either of the two preceding periods; for, as we have before reported, the series during this period and especially during the last week of this period were nearly as difficult as those of the Test-Series. To be sure, there were greater opportunities for larger scores, but this advantage was overweighed by the disadvantage of greater complexity.

2. *Effect of practice for different types of material:* Table IV shows the average number of units reported by the girls,

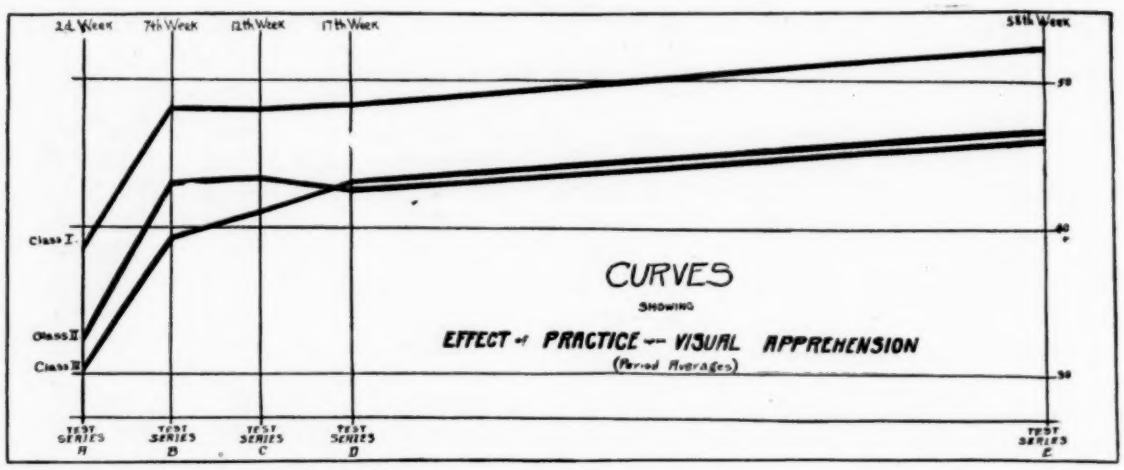

Plate III.

the boys, and the class as a whole for each type of material during the Test-Series, and the general averages for each type and for each series.

TABLE IV.

Average Record for Each Type of Material.

Test Series.		Average.	Average, Type I.	Average, Type II.	Average, Type III.	Average, Type IV.	Average, Type V.	Average, Type VI.	Average, Type VII.	*General Av. of Tests.
A.	Girls	8.07	3.33	2.83	3.37	2.00	3.90	4.38	3.44	3.33
	Boys	8.54	3.60	3.20	3.92	2,23	4.20	4.26	3.61	3.44
	Total	8.36	3.50	3.06	3.71	2.14	4.10	4.31	3.54	3.39
B.	Girls	8.15	4.40	4.61	4.77	3.27	5.07	5.00	4.77	4.13
	Boys	8.62	4.94	4.67	4.77	3.26	5.37	4.76	4.47	4.55
	Total	8.44	4.72	4.64	4.77	3.23	5.26	4.85	4.58	4.37
C.	Girls	8.23	4.45	4.36	4.56	3.75	5.30	4.75	4.35	4.25
	Boys	8.70	5.05	4.63	5.05	3.39	5.59	4.91	4.62	4.56
	Total	8.52	4.84	4.53	4.87	3.52	5.48	4.85	4.52	4.43
D.	Girls	8.31	5.18	4.93	4.72	3.73	5.36	4.90	4.40	4.34
	Boys	8.78	5.62	4.75	5.53	3.43	5.47	4.65	4.80	4.58
	Total	8.60	5.44	4.82	5.20	3.55	5.42	4.76	4.65	4.48
E.	Girls	9.90	4.16	4.20	5.11	3.72	5.52	4.91	4.58	4.85
	Boys	9.70	6.33	4.63	4.94	3.98	6.03	4.91	4.56	4.76
	Total	9.75	5.61	4.50	5.00	3.89	5.83	4.91	4.57	4.80
Gen'l Av. of Types.	Girls		4.30	4.18	4.50	3.29	5.03	4.79	4.31	4.31
	Boys		5.10	4.37	4.84	3.26	5.33	4.70	4.41	4.54
	Total		4.82	4.31	4.71	3.27	5.21	4.73	4.37	4.46

*The values here ascribed are obtained from Table II. It is the average number of units per exposure card for each Test Series—there being ten such cards in each series. The choice and arrangement of the several types of material varied from series to series. The average of the averages for the seven types, therefore, would not equal the value given under this caption.

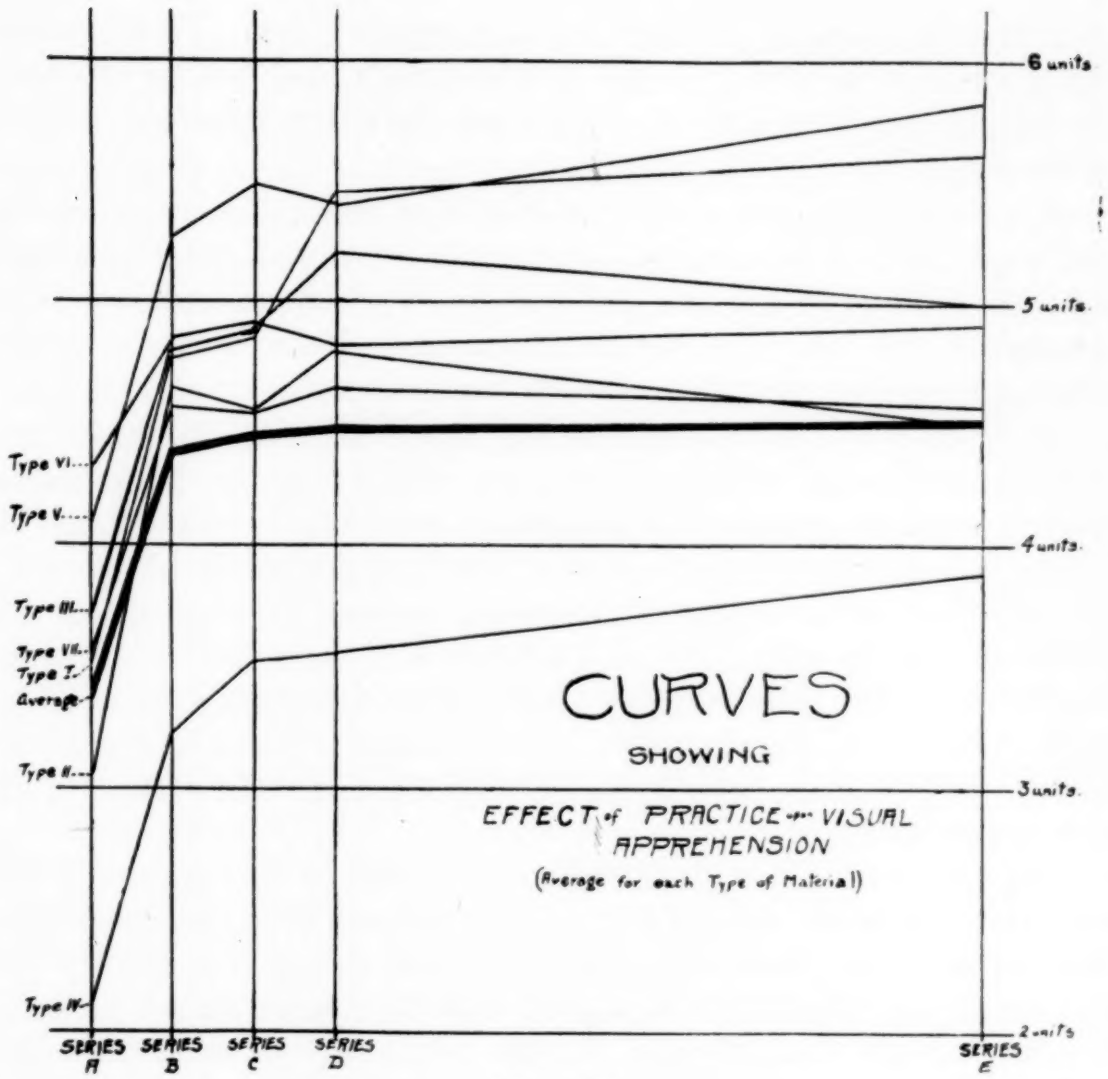

Plate IV.

This improvement in visual reproduction was common for every type of material, as can be seen by Table IV. The curves of practice for the different materials are virtually identical (Plate IV). The increase is very rapid at first and then becomes more gradual. Types II, V and VI actually suffer a decrease after the initial increase in *Test-Series B*. Though the greater part of the improvement in the other types of material was made also in *Series B*, nevertheless these reports (Types I, III, IV and VII) steadily improve to the end.

The table further shows that the average number of numerals, letters, combinations of numerals and letters, and of other discrete symbols that can be grasped in a 5-seconds exposure by the average pupil in the second grade lies before

practice between 3-4, after practice between 4-6. The average number of words of 2, 3 and 4 letters each that can be grasped is before practice only a little over 2; after practice it is a little over 3.

3. *Practice for the two sexes:* The general results are in no way altered by sex. What is true of the class as a whole is also true of the girls and the boys when considered separately. The improvement is the same in both cases: great at first and small toward the end of the experiment.

4. *Practice for the three classes:* The division of the school into good, medium and poor observers discloses some very interesting facts. The results of Class I and Class II offer nothing new; they merely confirm the general results. In both of these classes the improvement is very great at first, 10 and 11 units in the Test-Series, and 7 and 5 units in the Drill-Series respectively. After this initial gain there is in both cases no appreciable improvement; indeed, there is actually in the case of Class II a slight loss toward the end of the experiment.

Inspection of these data (Classes I and II or Classes I, II and III combined) would give little warrant for the conclusion that systematic practice would improve the native ability of visualization. The improvement, which we have seen was concomitant with the practice during the early part of the experiment, could, in the light of previous investigation, readily be explained by reference to other determining factors, such as familiarity with the material, the application of more efficient methods of work, the use of tricks of counting, grouping, and naming, the direction and restriction of attention.

The results of Class III, however, are not so easily explained. This class, composed of the poorer pupils, shows an entirely different practice curve from that which we have been led to expect. The initial improvement is not so large as that of the other two classes, but the efficiency increases throughout the entire experiment. The total increase is very marked and substantial, so that the members surpass their schoolmates of Class II in the last two Test-Series. The total improvement of Class III in the Test-Series, *i. e.*, between *Series A* and *Series D,* is 13 units, while that for Classes I and II is only 10.

5. *Retention of practice:* When *Test-Series E* was submitted to the class (58th week) the number of drilled pupils had been reduced by various causes to 19. The results and the personnel of this test appear in Table I. The average results are shown in Table II. There is a surprisingly large increase in the number of elements reported correctly to this test. The net gain amounts on the average to about 4 units. This improvement can not be explained on the grounds that the poorer subjects were absent from this re-test, and that the reports were given only by the more efficient pupils, for such is not the case, as can be seen by Table I. The loss of subjects in Class I and III was very evenly distributed, and Class II, since but one subject was absent, may be considered unchanged. We are forced, then, to inquire how it is possible that our practiced pupils, after a lapse of 41 weeks in the training, could display a net gain over their previous records. Three factors may have operated to produce this. In the first place we should expect some improvement due to age, for reasons to be advanced which will show a slight but positive correlation between age and efficiency in this test. In the second place, other investigators (*e. g.,* Book, quoted by Colvin,[9] p. 45) have shown that in experimental studies of learning there is often seen an increased efficiency of performance after an interval of rest—an increase which is usually attributed to the dropping out of partly formed bad habits of work. In the third place, despite the fact that the teacher was able satisfactorily to conserve the interest of the pupils throughout the experiment, nevertheless, continuous practice, as is well known, often tends strongly toward a reduction in spontaneous interest on the part of the learner, and it was perfectly evident to us that there was manifested during the retesting (*Series E*) a very exceptional degree of zeal and enthusiasm on the part of the pupils who had participated in the earlier work. Whether these three factors were all operative or to what degree they were severally operative is not clear; the fact remains that some agency or agencies were at work sufficient to more than counteract the loss of efficiency that would

---

[9]S. S. Colvin. *The Learning Process.* New York, 1911.

be anticpated by the lapse of time after the period of steady drill.

6. *Comparison of practiced and unpracticed subjects:* When *Test-Series E* was submitted to the children 11 new pupils took the tests. Of the new pupils, 9 were girls and 2 boys. The results of this test for both the practiced and unpracticed pupils, and the average age of each, appear in Table V.

TABLE V.

Comparison Between Practiced and Unpracticed Pupils.

TEST SERIES E.

Practiced.		Unpracticed.	
Av. Record.	Av. Age.	Av. Record.	Av. Age.
48.000	9.75	41.418	9.45

These data show that, even after a lapse of 9 months in the training, the practiced pupil is a much better observer than the unpracticed. The record of the former is nearly 7 units better than that of the latter. There can be no doubt that this is due to practice, for the probable error of the difference is only 1.5. Such a great difference can not be the result of mere accident; and it leads us to the conclusion that training such as ours does more or less permanently increase the subjects' ability to reproduce our sort of material.

Whether the practice is specific, and whether the improvement is due to a change in the native ability or merely to a change in method of observation, or whether it is due, as Colvin (page 44) suggests, to the feeling of familiarity and confidence with which the trained observers take up the work are not questions which can be considered at this point. We shall, however, take them up in their proper order.

7. *Comparison with adults:* Miss Aiken reported that her pupils who had gone through the training that she prescribed were able to give better records than the students of Clark University. To discover what was actually the relation between the reports of children and adults under our conditions of experimentation, one of the most difficult sections of *Drill-Series 3* was given to a class in Educational Psychology in Cornell University. There were 31 in the class, 12 women and 19 men, all of whom were juniors or seniors. The data were

graded according to the method that we have described before, and the students were divided, upon the basis of these grades, into equal groups of good, medium and poor observers: Classes I, II and III, respectively. The average record of each of these classes, the total average, and the average according to sex appears in comparison with the records of the children in Table VI.

TABLE VI.

Comparison Between Children and Adults.

	Aver. No. Units Reported.	
	Grammar-School Pupils.	University Students.
Class I.	55.5	71.0
Class II.	49.4	62.7
Class III.	48.1	54.2
Total.	51.5	62.3
Girls.	46.9	61.0
Boys.	54.4	63.2

These results show that the adults are, on the whole, better observers than the children, even though the children had had about three months' special training and the students none. It is, however, worthy of note that Class I of the grammar-school pupils give better reports than Class III of the adults; *i. e.*, the upper third of the children of the second grade give better reports than the lower third of the juniors and seniors of a large University. These results are, indeed, most surprising, for it is only commonly assumed that the brightest of any elementary school can survive the cuts up to and through the junior and senior years in college. These results then do in a measure resemble Miss Aiken's results, but only in a measure.

8. *Dependence on sex:* The results already reported show that the course of practice is the same upon the girls as upon the boys. A sex difference does, however, appear in another connection. In all of the test-series (with the exception of *Test-Series E*) in all of the drill series, and with nearly all the types of material, the boys do on the average better than the girls. They rank about two units above the girls in the test-

series (in Series E the girls rank 0.9 of a unit above the boys) and about three units above them in the drill-series.

The individual records of the subjects confirm these average results. The best observer in the school was a boy. There were 3 girls in the first ten observers (Class I), 4 girls in the next ten (Class II), and 4 girls in the last, the poorest, nine. The ratios are 3:7, 4:6, and 4:5, respectively.

The data obtained from the adult observers likewise corroborate these results, for both the average and the individual records show that the women students are slightly inferior to the men. The best observer among the adults was a man with a record of 82.5; the nearest woman had a record of 72.5. The poorest record was given by a woman who scored only 48.0; the lowest man was not much above her, however, for his record was only 48.5. Class I of the adult observers was composed of 6 men and 4 women, Class II of 7 men and 3 women, and Class III of 6 men and 5 women.

These results are very constant. They show that the effect of sex, though slight, is nevertheless real and apparent; and they lead us to the conclusion that men and boys are superior to women and girls in visual apprehension.

9. *Dependence on age:* There are numerous indications of a direct, though not very strong correlation between age and efficiency in these tests. In Table IV the average age of the school children and also that for the girls and boys is shown. The boys are nearly 6 months (0.47 years) older than the girls, and, as we have noted before, the boys give, with one exception, better records in these tests than the girls. In case of the single exception, *Test-Series E,* the relation still holds, for in this test the difference in age is reversed—the girls are over two months (0.2 years) older than the boys. This is further confirmed by the results in Table III, in which the average ages of the pupils for each Class are given. Class I, in which the best records in both the test and drill series are made, average the oldest (8.65); Class II, the medium, the next oldest (8.54); while Class III, which gives the poorest records in both the Test and Drill Series, averages the youngest (7.83). Table IV, in which the average age of the class and of the girls and the boys are given for each for each

type of material and period, likewise shows this relation between age and efficiency in work, as does also Table VI, in which the adults' and the children's averages for a single series are compared. The correlation between age and efficiency in these tests is evidently, therefore, positive. But when the coefficient was figured from the data in Table I, and not estimated from the averages in these tables, it was found to be surprisingly low. Pearson's familar "Product Moments" method was used to calculate the coefficient of correlation from the data appearing in the first and the eleventh columns in Table I; *i. e.*, the average number of units credited each subject during the fore-practice was correlated with their age.[10] The correlation thus figured was found to be only 0.19, with a probable error of 0.109; it is not as high as would have been expected from mere inspection of the averages in Tables III, IV, V and VI. This apparent discrepancy is due to the extreme variation of the data of a few subjects—Edward M., Lloyd M., Harry, Edward D., and Chester. The ages of these pupils are all over the average of the class, and their work is well under the average. Their ages show them to be pedagogically retarded 5, 1, 2, 2, and 2 years, respectively. A positive correlation under these circumstances is therefore significant, even though it be small. We may, therefore, safely conclude from the evidence at hand that there is a direct correlation between age and the efficiency in visual apprehension.

But that age, while a conditioning factor, is not of primary importance in the determination of the efficiency of the subjects in these tests is clearly shown by the low coefficient of correlation, by the small difference in age (0.3) of the practiced and unpracticed subjects in Table V and the corresponding difference in the value of their reports, which difference is too great to be explained on the basis of age; and also by the results shown in Table VI. In this table the record of Class I of the grammar-school pupils, whose average age, as is shown by Table III, is between 8 and 9 years, is better than that of Class III of the adult observers.

---

[10]To the list appearing in this table were added the data of three other pupils, Lyle, Edward M. and Lloyd M., whose names were omitted from Table I for reasons already assigned. Their average reports during the fore-practice were 61.1, 32.7 and 21.7, and their ages were 9.5, 12.0 and 8.5 years, respectively.

Neither can the difference of sex expressed throughout all of the Tables be explained entirely on the basis of age. The results of Table VI in which the men observers give better records than the women lead us to the conclusion that the effect of sex, though slight, is nevertheless real and apparent.

10. *Individual differences:* In the results of both the adult and the grammar-school subjects there appear very great individual differences. The records of the adults ranged from 82.5 to 48; those of the children of the first series of the experiment, *i. e.*, the first day of the fore-practice, from 67.5 to 20; and for the particular series given to the adult subjects, from 67.5 to 36. The most striking case of individual variation is that of Lyle B. His scores were so extraordinary that they seem worthy of report. His records always ranked at the head of the class. The cards with one seven-place, or one eight-place number, or the cards with two five-place numbers never seemed to bother him, and his records for the six three-place numbers varied usually between 14 and 16 out of a possible 18. Once he reported all of the numbers correctly. A duplicate of this card is shown among the sample cards in Type I. Unfortunately, we are unable to give a complete report of his work, for he only served in the experiment for a short time. As the data were not graded until long after the end of the experiment, the precocity of this subject was not discovered, otherwise a special study would have been made of his case.

11. *Relation to school standing:* The classification into Classes I, II, and III, which appears in all the tables, agrees fairly well with the division of the school made by the teacher on the basis of the school work, as can be seen by Table I. The school grade was divided into an A-class and a B-class. In our Class I, based, as we have said before, on the average score of the first week's work, there were 10 children, of whom eight were from the school's A-class and two from the B-class. In our Class II, composed also of 10 children, six were from the A-class and four from the B-class. In our Class III, composed of nine children, three were from the A-class and six from the B-class. The average score of the children in the A-class during the period of fore-practice was 37.8; that of the children in the B-class was 32.9.

These results seemed to indicate a close correlation between visual apprehension, as indicated by efficiency in these tests, and school work. The records of the childrens' school work were therefore obtained, and a correlation was drawn between their school grades and their efficiency as shown by their average score in the period of fore-practice. In computing the correlation the average grades for the first term, the term just preceding our work alone were used. These grades were chosen so as to eliminate the effect of practice. The correlation was also calculated separately for the two classes (A and B), because the school work was different for each class, and therefore the basis of the teacher's grading was different. The correlation for the A-class, figured by Pearson's method, was 0.85, the probable error 0.044; for the B-class 0.20, the probable error 0.167.

12. *Effect of training on school work; problem of transfer:*

Table I and Table VII give the data upon which these correlations were based. The school grades appear in Table VII. The grades in all of the school studies and the averages are given here for both terms; for the term preceding the experiment, and for the term during which the experiment was conducted.

An inspection of this table shows, if the marks are reliable, that the pupils uniformly did better work during the second term than the first. This is more clearly shown in Table VIII, in which appear the averages for each study and the total average of all the studies for each class of subjects (divided according to the previous tables into our Classes I, II and III), for the entire school, and for the girls and boys.

The results of this table agree with the conclusions already drawn. There is a close correlation between the school work and visual apprehension on every score but that of sex. Class I gives the highest score during the fore-practice, and their school grades average the highest; Class II occupies a medium position in both tests and school work; and Class III ranks the lowest in both. Sex, however, shows a different relation. The girls rank higher in their school work than the boys, whereas in the tests their records were uniformly lower. Not only is the general average of the school

TABLE VII.

School Grades.

	Pupils.	Reading. 1	Reading. 2	Writing. 1	Writing. 2	Arithmetic. 1	Arithmetic. 2	Spelling. 1	Spelling. 2	Grammar. 1	Grammar. 2	General Studies. 1	General Studies. 2	Average. 1	Average. 2
Class I	Lloyd M.	88	90	60	75	75	85	85	90	90	90	85	90	80	87
	Lura	85	85	85	85	85	85	85	85	90	92	85	85	86	86
	Ezra	70	85	70	80	75	75	60	80	80	85	80	80	72	83
	Raul*	..	..	90	90	90	90	..	..	..	..	80	85	86	88
	Edward B.	90	90	75	80	75	75	85	90	85	90	85	90	85	86
	Reginald	80	85	80	85	85	85	80	90	80	85	85	85	81	86
	Ethel	90	95	88	90	80	85	90	90	85	90	85	90	86	90
	Frank	75	85	70	80	70	80	50	70	75	80	80	85	70	80
	Sylvia	78	80	75	85	60	70	60	80	60	75	80	80	69	78
	Paul	85	85	75	80	80	90	75	80	80	80	80	85	79	83
Class II	Dorothy	90	90	80	80	85	90	75	85	75	85	85	90	82	87
	Clarence	75	75	75	80	60	60	80	85	80	85	80	80	75	78
	Lindsay	85	80	75	75	85	75	60	60	85	85	80	80	78	76
	John Cn.	85	90	50	85	90	95	85	90	85	90	85	90	80	90
	Carl†	N	80	..	75	..	75	..	75	..	70	..	75	..	75
	Eileen	85	80	85	90	85	70	85	85	80	85	80	80	83	82
	Levena†	..	85	..	60	..	70	..	80	..	85	..	85	..	77
	Truman	80	75	90	85	80	75	60	60	80	80	75	75	76	75
	Wilkenson	80	75	70	70	80	75	75	82	80	80	80	85	78	77
	Bernice	80	75	85	80	60	60	82	85	80	80	75	80	77	77
Class III	Chester	80	85	75	75	75	65	75	75	80	80	75	80	77	77
	Margaret	80	85	85	85	50	50	75	80	80	85	80	85	75	78
	Edward D.	65	70	85	85	85	80	60	70	80	85	75	80	75	78
	Francis	80	80	80	85	85	85	80	80	75	75	75	80	79	81
	John Cy.	50	75	60	85	85	90	75	75	50	70	75	80	67	79
	Evert	70	80	85	90	75	50	70	70	80	90	80	85	77	78
	Mercedes	80	85	70	70	40	35	70	75	75	85	80	75	69	70
	Helen	80	85	50	60	80	85	70	80	90	90	80	85	75	81
	Harry	60	30	40	70	70	50	40	50	50	60	70	70	55	55

1 = grade for first term.
1 = grade for second term.

*Raul had just immigrated to this country from Spain. His English was very poor, therefore no grades were given him in studies requiring a knowledge of the English language.

†These pupils were not members of this class during the first semester, and consequently their grades for this semester were not reported.

work higher for the girls than for the boys, but their averages in every study except arithmetic are higher.

Special attention is called to the fact that the averages for all of the studies (with the single exception of arithmetic) are higher for the second than for the first term. Whether this improvement is due to the training in our tests, whether

TABLE VIII.

Averages of the Grades of the Pupils.

Classes.	Reading.		Writing.		Arithmetic.		Spelling.		Grammar.		Gen'l Lessons.		Average.	
	1.	2.	1.	2.	1.	2.	1.	2.	1.	2.	1.	2.	1.	2.
I.	82.3	86.6	76.8	83.0	77.5	82.0	74.4	83.8	80.5	85.2	82.5	85.5	79.0	84.3
II.	82.8	80.7	74.2	80.0	78.1	74.2	77.4	81.0	80.7	81.4	80.7	83.5	79.3	80.6
III.	71.6	72.8	70.0	78.3	71.6	65.5	68.3	72.7	73.3	80.0	76.6	79.4	70.9	75.1
Total results.	78.6	80.8	73.7	80.5	75.1	74.2	73.0	79.0	78.0	83.0	80.0	82.9	76.7	79.9
Girls.	82.8	84.0	78.3	79.0	70.0	70.5	77.2	82.5	77.0	84.2	80.5	83.0	77.6	80.5
Boys.	75.8	78.6	70.9	80.3	78.4	76.0	70.3	77.1	77.3	82.3	79.6	82.8	75.4	79.5

1=Average for first term.
2=Average for second term.

the transfer was direct or intermediate, we can not here say. The improvement was very uniform for all of the observers, as can be seen by Table VIII, and it is so large that it can not be neglected. All the more surprising are these results when it is considered that the improvement in the school work was made in spite of the adverse conditions under which the school was held during the last half of the year. These results at least strongly indicate a transfer of training.

It should be reported in this connection that the teacher during the early part of the experiment, in her enthusiasm for the work, and quite unknown at the time to us, copied our method of quick visual presentation in some phases of her daily work, *e. g.*, in teaching spelling. It is possible that the improvement in the school records during the second semester may be due in large measure to this direct application of the method.

VIII. The "Aussage" Test.

In order to ascertain whether our training was specific, whether our pupils had really become noticeably better observers, and whether there was a transfer in training as the results of and improvement in the school work would seem to indicate, an Aussage test was given to the pupils who took *Test-Series E*. These tests were given to the children in April, 1913, in the sixty-sixth week of the experiment. They were administered by Mrs. L. R. Hill, who made the following report:

The children remaining in the class of those who had been practiced in the tests of visual apprehension (21 in number) and the newcomers who had not been thus practiced (15 in number) were all subjected, individually, to the Binet "card-of-objects" tests as described in Whipple's *Manual of Mental and Physical Tests* (First edition, Test 32, A). The comparison of these two groups, practiced and unpracticed, was made, first in terms of number of objects recalled, and secondly in terms of numbers of answers correctly made to the 50 questions embodied in the printed "interrogatory" for this test.

Table IX shows that the practiced group were superior to

the unpracticed group in the number of objects recalled after 30 seconds exposure of the card.

TABLE IX.

Results of Supplementary Test of Observation.

Total number of objects recalled.....	1	2	3	4	5	6	Aver.
Children in practiced group.....			2	2	8	9	5.1
Children in unpracticed group.....			2	5	2	6	4.8

In ranking the children for their answers to the interrogatory one mark was given for each correct reply and 0.5 for each partially correct reply. The results show for the practiced group an average score of 32.8 (of a possible 50), for the unpracticed group an average score of 27.4. The difference between these two averages, 5.4, has a *P. E.* of 2.1, and is therefore not likely to be a mere chance difference.

We conclude from this subsidiary test, therefore, that the practice given the children in the visual apprehension of numbers, digits, drawings, etc., has had an effect that has persisted at least 50 weeks, and that has been sufficient after that interval to make the practiced children superior to their unpracticed mates in recalling and reporting correctly visual material of a different sort (colored instead of black and white, heterogeneous instead of homogeneous, displayed for 30 instead of for 10 seconds and demanding detailed description instead of mere enumeration). While it is true that the Binet card-of-objects is likewise a test of recall of material presented visually, it seems sufficiently unlike the material used in the practice series to lend support to the conclusion that the original work of drilling the children has produced a training that has not only persisted, but also "spread" to some extent to other functions.

IX. Conclusions.

A general statement of the problem, the method and the factual results obtained has been presented in the summary that precedes this article. The conclusions to be mentioned here refer to the general issue raised by the work. We conceive the moral of this study to be that, while the mental

processes of children are like in kind to those of adults, their lesser maturity alters appreciably the outcome of experiments dealing with the effects of prolonged drill in the exercise of a mental activity. The careful, though less extended experiments of Whipple and Foster showed no appreciable effects of drill upon adults, save those rather temporary effects explicable as adaptation to experimental conditions and to the specific task, that is, as the development of special devices for facilitating the exercise of already matured capacities. Our more lengthy experiments with children, however, have not only showed more decided practice-effects, but have also rendered it at least quite possible, if not practically certain, that these practice-effects have brought about a permanent modification in the mental traits exercised, and what is more, a modification that certainly seems to have made itself felt in a number of ways outside the special tests we made (as in improvement in school work and increased efficiency long afterward in supplementary tests of observation and report). In this respect our experiment, therefore, may be regarded as contributing some evidence in favor of a restricted belief in formal discipline.

We suggest that the general principle motivating our work—that of retrying in the classroom upon growing children experimental problems that have too often been regarded as settled by tests upon a limited number of selected adults—is one worthy of extension into many other phases of experimental psychology.

[THE END.]

AN EXPERIMENT IN MEMORIZING VERSUS INCIDENTAL LEARNING.

E. A. KIRKPATRICK,

Fitchburg, Mass., State Normal School.

The general problem to be solved is "Is it best (1) to memorize, then use knowledge, or (2) begin at once to follow directions in doing, or (3) use knowledge already acquired in doing?" The more special problem tested by this experiment is, "What is the best way of gaining facility in using a multiplication table?"

The traditional method of the schools is to have the children memorize the multiplication table, then after it is learned and the children have been tested by various drill exercises, they are expected to use it with facility in written multiplication. Another method that might be used would be to place in the children's hands a multiplication sheet which they could use in written multiplication with the hope that after using it a good while they would incidentally learn the combinations and be able to work without the key sheet. A third possible method would be to allow the pupil after learning some of the combinations in addition and learning how to derive multiplication combinations from them to begin written multiplication, figuring out each combination as he needs it.

It would require considerable time and care to test these methods with primary children under ordinary school instruction, so an experiment embodying the same principles was devised for older pupils. All those to be tested were supposed to know the multiplication table usually taught in school, but not to know the products of seven by the prime numbers from 17 to 53, inclusive, and the experiment was conducted to determine the relative advantage of three methods of learning these combinations. A practise or test sheet was prepared containing the prime numbers above named with a smaller figure seven beneath them arranged in 10 lines of 10 such groups of figures each. Another sheet, known as the key sheet, indicated the products that could be substituted for each group of numbers. In two methods of testing the pupils were not informed that the numbers on the key sheet were products, and the majority of them did not discover the fact, and very few of those who did made use of their knowledge.

In the first experiment a class of 20 young men in a normal school were divided according to the position in which they happened to be sitting into two equal divisions, one of which was to memorize the key and the other to begin at once to practise writing the substitutes given in the key. In a preliminary test all wrote the substitutes for one line. After that one group practised while the other group memorized for four and, in most cases, for five days, then began practising (using the key if they needed it). The preliminary test revealed slight difference in the rate of the two groups.

To find the time required to do each line the writer called the time at intervals of five seconds, and the pupils wrote down the approximate number of seconds required for each line. Ten lines were done each day. The total time for each day's test, including the time of folding the paper and getting it placed for the next line, averaged about 10 minutes. Those who were memorizing had therefore studied the key from 50 to 60 minutes before beginning their practise.

The average time per line for the practisers the first day was 25.9 seconds, while the average time of those who had spent four or five days in memorizing was slightly greater, being 26.2 seconds. The memorizers were usually less rapid in doing the first few lines than before memorizing, because they required more time to think of the numbers than to look on the key sheet and see what they were. At the close of the second day of practise, or the seventh day of the experiment, the memorizers averaged 19.4 seconds per line, which was slightly better than the 21.9 seconds per line required by the practisers the second day of the experiment. On the tenth day of the experiment, the fifth or sixth day of practice for the memorizers, their record of 17.2 seconds was slower than the fifth or sixth grade of practise for the practisers by 3.1 seconds.

After an interval of about three weeks, during which nothing was done with the experiment, a final test was given. The subjects first reviewed by doing five lines as before, using the key sheet if they needed it, then they were given the critical test of efficiency in use, under slightly different conditions. In this test they wrote as many products as possible

without the key sheet in two minutes, following the lines down and up instead of from left to right, and not stopping to fold the paper between lines. Five of each group remembered all the products in this test, while the others either drew a line in place of the products which they did not know or figured the product (which they now knew could be done). The memory group wrote on an average of 40.9 answers, and the practising group 46.2.

It appears, therefore, that from every point of view the results averaged better for the practise group than for the memory group. There were two individuals of the memory group who learned the key early, one in three and one in four days, and these were able to use their memory very quickly soon after beginning practise. It is possible that these did as well or better than they would if they had practised without memorizing for the same length of time.

A few individuals of the practise group made very little progress in learning the key. A study of their method of working showed that they did not, like the others, look from practise sheet to test sheet before writing each product, but that they kept their eyes on the key sheet most of the time and soon wrote almost as rapidly as if they were merely copying a set of figures without looking at their writing. They thus attained a high rate of speed in a short time, but did not learn the key so fast as those who gave more attention to the practise sheet and the correspondence between the practise and key sheets.

The next test was tried with two classes of freshmen normal school students of about 25 each, all of them young ladies, except four. One class practised, using the key as previously described, for eight days, while the other had no key, but multiplied the numbers and wrote the answers as rapidly as possible the same number of days. In the final test the average number of answers written in two minutes by the group practising with the key was 25.4, while the computing group wrote 44.3 answers. The best of those practising with the key were nearly, but not quite, as good as the best in the computing group, but only one wrote fifty or more answers and six not over twenty, while in the group that computed seven

wrote fifty or more and only one less than twenty. Those who had not memorized the key were helpless in the final efficiency test. Only two or three knew they could get the answers by multiplying. Those in the computing group were perfectly at home and only a little slower than those who incidently memorized the final products.

The experiment was also tried in a similar way with children, though an outbreak of scarlet fever kept some pupils and training teachers out of school part of the time and caused slight irregularities in the experiment which it is not necessary to describe in detail. There were about 20 children in each room, but some of them were absent a day or two, and in one there were only 15 that took the final test. One sixth grade, average age 11½ years, practised with the key 10 days; one sixth grade, average age 11½ years, computed for 10 days; one fifth grade, average age 10¾ years (said by the supervisor of these rooms to be brighter than the sixth grades), memorized for five days, then practised one day, then memorized three days more, while another sixth grade memorized for four days, then practised for eight days. The results in the final efficiency test of two minutes was that the number of products written by the computers was 27.7; by the practisers, 19.1; by the fifth-grade memorizers, 10.1, and by the sixth-grade memorizers and practisers, 27.4.

Table Showing the Significant Figures.

Normal Students.

Group of men who memorized four and five days, then practised with key five days:

Preliminary test of one line	33.5
Average the first day of practise	26.2
Average the second day of practise	19.4
Average the fifth day of practise	14.2
Average after vacation	17.2

Number of answers in two-minute efficiency test, 40.9.

Group of men who practised with the key 10 days:

	Sec.
Preliminary test of one line	32.0
Average first day of practise	25.9
Average second day of practise	21.9
Average fifth day of practise	17.3
Average tenth day of practise	13.1

Number of answers in two-minute efficiency test, 46.2.

Group of women who practised with key eight days:

	Sec.
Preliminary test of one line	26.2
Average per line first day	22.1
*Average per line second day	....
Average per line eighth day	11.7
Average per line after vacation	12.3

Number of answers in two-minute efficiency test, 25.4.

Group of women who practised computing eight days:

	Sec.
First line	32.0
Average first day	25.3
Average second day	18.9
Average eighth day	11.7
Average after vacation	13.8

Number of answers in two-minute efficiency test, 44.3.

Group of children who memorized 10 minutes a day for five days, practised one day, memorized three more days, then after three weeks took final test:

	Sec.
Time required for preliminary test of one line	77.4
Average time per line after five days' memorizing	49.5
Average of five lines after vacation	41.6

Number of answers in two-minute efficiency test, 10.1.

Group of children who practised with key for 10 days:

	Sec.
Preliminary time	61.6
Average per line first day	44.4
Average per line sixth day	23.3
Average per line tenth day	19.1

Number of answers in two-minute efficiency test, 18.9.

Group of children who memorized four days, then practised eight days:

	Sec.
Time required for preliminary test of one line	59.4
Average per line first day of practise	35.4
Average per line sixth day of practise	19.4
Average per line eighth day of practise	16.8
Average per line after vacation	16.7

Number of answers in two-minute efficiency test, 27.4.

Group that practised computing 10 days:

	Sec.
First line	64.2
Average first day	45.7
Average sixth day	29.8
Average tenth day	24.1
Average after vacation	25.0

Number of answers, 27.7.

These preliminary experiments are crude and too few in number to settle the whole question of the best method to be used in various lines at various ages and in various stages of

*Omitted because some of the records for this day were mislaid.

progress, but there is so little evidence of any advantage gained by memorizing unassociated with practise and such marked evidence of the efficiency of those who used previous knowledge as they were learning that it is hard to believe that more exact and extensive experiments will give essentially different results. It seems that memorizing apart from use is the poorest method of all, drill in using somewhat better (if there is not so much effort to attain speed that there is little incidental learning), while the method of using previous knowledge as a guide in practise is the best of the three. A still better method would be to practise either with a key or by computing with the purpose not only of doing the work, but also of learning the products so that it will not be necessary to refer to key or to compute while doing the work. Some individuals would probably do best by considerable attention to memorizing as they work, while others would learn almost as quickly without trying to do so.*

The results indicate that in many lines of teaching there has been a tremendous waste of time, energy and interest in first memorizing, then later practising, the use of what has been learned. Also that pupils do better when practise is guided by their own knowledge than when it is directed by authority of book or teacher.

In manual lines there has been considerable change recently from systematic manual training to less systematized work in the practical arts, which means that learning is being more closely associated with practise and with practising for a purpose.

In language the alphabet is now almost universally taught incidentally while learning to read, instead of being memorized separately, as formerly. Rules of speech and pronunciation are still separately taught in many schools, but there is a growing tendency to put more emphasis upon practising and more or less incidental teaching while reading, talking and writing. Spelling is also taught less by separate drill than formerly. There are also in use methods of teaching facts of geography and history that involve a more or less incidental learning of facts that were formerly memorized separately. In general, however, tradition and examination tests

*See supplement.

have made these changes toward more interesting and efficient methods of learning slow and incomplete. This is largely because teachers do not believe that incidental learning is as sure and rapid a method as the method of direct memorizing.

In arithmetic, especially, memorizing and drill methods still hold their places, in spite of the introduction of various innovations. Most teachers will be horrified if told that the sacred multiplication table need not be made a subject of special memorizing and drill, yet such appears to be the case. After children have learned to count they can learn to compute all the addition, multiplication and other useful tables. After they know how to compute they can learn products incidentally by computing, whenever this is necessary in working written examples and problems. To illustrate, after learning to count by ones they can easily learn to count by twos, then by threes. The knowledge of the twos will help them to get that of the fours, and of the threes to get that of the sixes and the nines. The tens are almost learned in learning the ones, and the fives, as half way between, are easily gained. The child then has a basis for computing all additions except the sevens, and these he can get from the three and four combinations. From the addition table he readily gets the subtraction and multiplication tables, and from them the division tables. It is true that these things are now recognized to a considerable extent, but emphasis is still placed upon *memorizing* the tables rather than upon learning to compute them, and much time is spent in drilling on them before the children are given written multiplication and problems with large numbers in which tables are needed. It is probable that at least a year in numbers is wasted in special drill on the various combinations beyond what would be necessary if emphasis were first placed on learning how to compute tables, then upon working examples and problems with larger numbers, computing products till they were learned incidentally.

This last statement has, of course, not been proved experimentally, but is merely an opinion based on inference from general principles and on a good deal of personal observation. Just how much time could be saved by the use of computation and incidental methods in number work as compared with memorizing and special drill methods is not known, but there

can be no doubt that there is no need to have children *memorize* any tables.

It is hoped that such experiments as the above will encourage superintendents to try the method of incidental learning in some of their schools through a course of years. In doing so, tests should be used to determine the efficiency of this method as compared with that of separate memorizing and drill. The Courtis Tests may be used in arithmetic, while in other subjects drill exercises may be modified so as to serve a useful purpose as tests. Occasional tests should be used not merely for experimental investigation, but as a means of helping teachers and pupils to judge the progress that is being made.

SUPPLEMENT.

After this paper was sent in two divisions of normal students, numbering 27 each, practised computing, one with the idea of gaining in speed and the other with the idea of learning the products while practising. The records made for each line naturally emphasized speed in both divisions, while mention of the fact that they need not take time to compute any products that they knew, called some attention to memorizing. The idea of learning was emphasized in one division by asking them to keep that purpose in mind and by having them not compute answers for any line each day, but instead think of all the answers they knew. Those practising for speed gained rapidly at first and three of them learned all of the products, while those intending to memorize were slightly slower at first, but nine learned all of the products. In the final efficiency test given as described above there was no significant difference (60.1 and 60. being the average number of answers written). Three weeks later the average time for the two divisions was practically the same. When, however, a two-minute test was given in which they were not to write products, but to make horizontal marks in place of all products they remembered, and vertical lines when the products were not remembered, the number of lines of both kinds made by those who had practised for speed only averaged 77.8, while those who intended to memorize averaged 86. Evidently one division had gained more in rate of writing products and the other in rate of thinking them.

PSYCHOLOGISTS' SONG.[1]

[1]Professor Stern's *Psychologenlied* was sung with great eclat at the *Dritter Deutscher Kongress für Jugendbildung und Jugendkunde* in Breslau. It is here translated from the German by Mrs. James Burt Miner. It is intended to be sung to the tune of "Crambambuli."

PROF. WILLIAM STERN,

University of Breslau.

Every class its separate song is singing,
Civilians sing, the battle hymn
To heaven's vault is hurled,
The workman's shop with song is ever ringing,
One group alone stands without tone
Quite songless in the world.

This lack has caused us pain and grief
For which we now will bring relief
With this first Psychologic lay
That blooms today.

Praise of Psychologists.

The Psychologist with hand that is unerring
Can bring to light what's locked quite tight
Within the human heart.
He can reveal by scientific querying
The force of will, the feelings' thrill,
And how ideas start.

He even can present the proofs
Of what is done by cloven hoofs,
And all that "Kluge Hans" may know
Yes, he can show.

THE SAME.

Psychologists believe broad minds the finer,
Though they give more thought than others wot
To the "Reaction Time."
And every one be he adult or minor,
Though he genius be, though normal he,
Though he's demented quite,

Is studied, 'xamined and advised,
Is patho, psycho-analyzed.
Till in the end he's laid to rest
With "mental test."

CHORUS OF PSYCHOLOGY'S ENEMIES.

Psyche, goddess pure, so sad your story.
You butterfly, so frail and shy,
Your heavenly color's paled.
In the dark room, in silent laboratory
With apparatus you're approached,
With calculus assailed.

O, tell us how you fare, my child
Who "Ca(n)ttell?"
You "Dearborn" "Angell," "Dewey" "Wilde,"
On "Sea-shores" of the eternal night,
Maltreated wight?

The Mechanism of Ideas.

Association—truly 'tis a word of magic!
Twill, if you please, with greatest ease
Break every problem's seals.
And many seek with it alone to conjure
A counterfeit so true that it
The soul's real form reveals.

Ideas check or aid each other
They jostle, crowd and squeeze one another.
And lo! A Psychologic hash
Comes from this clash.

Psychological Analysis.

O, Freud, O, Freud, you spark of heaven's making.
(I can but hint. Unfit to print
Is much that I would sing.)
Tis only rogues of innocence are prating.
All unawares subconscious snares
Will soul-destruction bring.

All of your speeches, dreams and acts
Are complexes; but hardly facts.
The infant in the crib today
Is a roué.

The Occult.

We also boast Psychologists undaunted
Who tackle now with placed brow
The fourth dimension grim.
By telepathic evidence they seem forever haunted
And dual personalities they demonstrate with vim.

The over I, the under I,
The double I, and bye and bye
The "second" that's in "self" concealed
Becomes revealed.

Conclusion.

Hear! Ye Knights of soul investigation!
As one arise, ye men so wise,
Ye who are patrons, too!
Psychology's fast friends of every nation,
Your voices raise to sing the praise
Of these our labors true.

A great cheer for our science give
May Psychology forever live
And prosper 'till we reach our goal
Full knowledge of the soul.

COMMUNICATIONS AND DISCUSSIONS.

A CLASS EXPERIMENT IN SCORING HANDWRITING.

To relieve the teaching of the subject of education from the montony of the monologue, or even of the dialogue, and make it more interesting and more efficient, it is necessary to introduce work of a practical nature. To devise suitable exercises for class work is not an easy task, but the success which attended the following trial test seems to make it worth reporting, and it might also help to suggest other tests of a similar nature.

In lecturing on writing it is no improvement on older methods merely to enumerate the advantages of the use of a scale in estimating the value of various samples of handwriting, nor is it possible for the members of an ordinary class to devise a scale; the mathematics in the case of Thorndike's scale is too involved and there is not available time required to prepare a scale on the lines of Ayres. The following test, however, seems to serve as the *via media* in this case:

A sample of the handwriting of each of three students was taken and the three samples designated, respectively, A, B, C. These samples were affixed to the classroom wall near the exit. The students were instructed on leaving the class to assign on their notebooks to each sample a value in even tens, a coypbook headline being regarded as the standard, 100 per cent.

Ayres' scale was affixed before the next lecture, and on re-entering the class the students revalued the samples with the aid of the scale. The arrangement in a student's notebook appeared thus:

	A.	B.	C.
Without scale	90	80	40
With scale	80	60	20

Meanwhile, the table given below, but blank, was written on the blackboard. The students were then asked to indicate how many had assigned to A without scale 100, 90, 80, 70, etc., per cent.; then A with the scale, and the same with B and C. The results were as follows:

Per cent.	A		B		C	
	Without scale.	With scale.	Without scale.	With scale.	Without scale.	With scale.
100	..	..	..	..	..	..
90	2	2	2	..	..	..
80	8	26	13	5	..	..
70	12	4	8	6	..	..
60	10	4	8	25	..	..
50	3	1	5	1	1	..
40	2	..	1	..	8	9
30	..	..	..	..	16	20
20	..	..	..	..	11	8
10	..	..	..	..	1	..
0	..	..	..	..	..	..
	37	37	37	37	37	37

From such figures students will readily draw conclusions as to the need of a scale in their estimations of handwriting. In the case of Sample A, the value is evidently 80 per cent. Without the scale only 8 of 37 students in training for teachers who have had considerable practice in estimating the handwriting of school pupils assigned to the sample the correct value, whereas with the scale 26 assigned the correct value. The figures in the cases of B and C demonstrate that when, even with the help of the scale, the correct values are not assigned to the samples, these values, nevertheless, vary less from the correct values when the scale is employed.

Results like the above, worked out from the students' own judgments, impress students more than references to authorities, however distinguished; and if the conclusions viewed for experiments in education are to be incorporated into the practice of the ordinary class teacher, it must be through some such demonstration as the above.

ROBERT R. RUSK.

St. Andrews, Scotland.

IDEATIONAL TYPES IN ARITHMETIC.

In 1908 the following experiments were made on 494 children of the male sex of the various grades from the first to the eighth, inclusive, of one of the public schools of New York City. The ages ranged from 7 to 15 years.

Purposes—To determine—

A. Whether there are distinct ideational types in arithmetic.
B. The relation of these types to the immediate memory of numbers.

C. The distribution and development of these types in the grades.
D. The relation of intelligence to the types of mental imagery.

Experiments.

Three series of numbers varying in length from 2 to 10 were given to the children in the following manner:

A. The numbers were read to the children, and they were required to write the ones they remembered.
B. The numbers were placed on the blackboard and covered. The children were asked to reproduce them.
C. The numbers were read and the children repeated them aloud. They were then reproduced.
D. The numbers were placed on the blackboard and read aloud by the children. They were then reproduced.

Results.

A. Are there ideational types in arithmetic?
   1. If we mean by this question that children are visual only or auditory only, then our results answer in the negative. Among 494 children, there were about 10 children who relied exclusively upon one kind of reproduction—that is, children who produced absolutely no results in any form of presentation except one. The vast majority of children returned some results in all forms of presentation, except that they did best in some particular form. We must conclude, therefore, that nearly all school children belong to a mixed type and possess greater ability in absorbing and retaining numerical facts in one direction than in another.
   2. Although most children are of the mixed type, yet certain methods of presentation will produce better results than other methods.

B. The relation of these types to immediate memory of numbers.
   1. The best results in early years of school life are obtained from auditory presentation, in later years from visual and visual motor presentation.
   2. The best results in all forms of presentation are obtained in the fifth and sixth years of a school child's life.
   3. The auditory motor presentation gives very poor results throughout the grades, showing that loud speech move-

ments are a hindrance instead of a help to immediate memory.

4. The child's retentive power for number is greatest about the fifth or sixth years of its school life—that is, memory, without regard for content or for logical connections, is strongest in the eleventh or twelfth year of the life of the individual.

C. The distribution and development of the types in the grades.

1. The vast majority of the children are of the mixed type in arithmetic. There are no types in number imagery in the sense that children think exclusively in one kind of imagery.
2. In every class more than one-fourth of the children are visual motor; in the third and fourth grades, more than one-half of the children belong to this type.
3. From one-fifth to one-half of the children in the various grades are visual, except in the first grade, where only one-twentieth of the children are of this type.
4. The auditory type predominates in the first and second grades. The visual or the visual motor in all the other grades.
5. There is a rapid increase in the visual type from the first to the fifth grade.
6. There are more children of the visual motor type in the grades than any one of the other types. This is the predominant type among our children.

D. The relation of intelligence to the types of mental imagery.

1. In general, bright pupils seem to use the visual type of imagery in preference to the auditory type. It is found also that visual or visual motor presentations of arithmetical subject-matter are a decided help for bright pupils. Auditory presentations act as a hindrance to the imagery of bright pupils.
2. Dull pupils do not seem to belong to any pronounced visual or auditory type.
3. Children of a pronounced auditory type, whether bright or dull, find the addition of the motor element, in this case loud speaking, a distinct hindrance to their type of imagery. This is contrary to what is generally be-

lieved to be the case. It has been accepted that the addition of the motor element acts as a help to any type of imagery, whether visual or auditory.

Conclusions.

1. The results of our investigations as to the distribution of mental types in the grades may be utilized in the partial solution of the problem of retardation. It is highly probable that a teacher may be of a predominantly auditory type and yet have before her children who belong to a predominantly visual type. As a result, we find her adopting methods which are largely auditory and thus failing to reach the vast majority of her children. A careful investigation of retarded pupils will no doubt show that there are many children in our schools who have failed to comprehend instruction, who have not succeeded in keeping up with their grades, because their mental type of imagery has not been understood, recognized and taken into account by the teacher in the presentation of the subject-matter of the curriculum.

2. We have found that immediate memory is at its best in the fifth and sixth grades. We have found that children in these grades can retain and reproduce longer series of numbers than those in the seventh and eighth grades. It can readily be seen that since the mechanical memory seems to be strongest in these grades, it would be decidedly unpedagogical to leave to the seventh and eighth grades tables that have to be committed to memory. Therefore, in the making of a course of study it would be well to have all facts which are to be retained by the mechanical memory as such disposed of during the first six years. Should this be an indication of the general process of the mind in acquiring knowledge in every subject, then the teaching of languages, and especially the time of beginning them, must undergo a change. Instead of making French and German electives in the eighth year of school, it would be better for them to be introduced before the seventh year. The plasticity of the memory, being greater at that period, a greater economy of learning would follow. The good results obtained in the German Gymnasium in the study of Latin are no doubt due to the fact that the language is commenced and studied in the fifth and sixth years of the child's school life.

3. A current educational maxim, which has never been ques-

tioned, has been, "In teaching, appeal to all the senses possible." We have noted that all children who are of a pronounced auditory type find the addition of the motor element as actually hampering them in their intellectual operations. Hence, if we attempt to carry out the maxim, we find that we are hindering some children instead of assisting them. So that we might well consider other educational maxims which as the result of the experience of some teachers find their way into educational practice and examine them in the light of experimental investigations as to their general truth. We are too prone, in pedagogy, to adopt methods of procedure which are promulgated as the result of experience or unscientific observation, and it is probable that in many instances we are actually hampering the pupils instead of enabling them to acquire knowledge economically.

ISIDORE SPRINGER, PH.D.

New York City.

THE
JOURNAL OF EDUCATIONAL PSYCHOLOGY

INCLUDING EXPERIMENTAL PEDAGOGY, CHILD PHYSIOLOGY AND HYGIENE, AND EDUCATIONAL STATISTICS

Edited by

W. C. BAGLEY, C. E. SEASHORE,
J. CARLETON BELL, Managing Editor. GUY MONTROSE WHIPPLE.

Published monthly except July and August by
WARWICK & YORK, INC.,
BALTIMORE, MD.

Manuscripts for publication, books or other material for review, and news items of interest to educational psychologists should be addressed to The Managing Editor, J. Carleton Bell, University of Texas, Austin, Texas. Research contributions from England may be sent to W. H. Winch, Esq., Melville Villa, Overhill Road, Dulwich, London.

The Journal is issuing a series of Monograph Supplements for the publication of more extensive researches in educational psychology. For details prospective contributors may apply to Guy Montrose Whipple, Cornell University, Ithaca, N. Y.

The price of the Journal is $2.50 per year of ten monthly issues. Foreign postage is 20 cents extra for Canada and 30 cents for other countries in the Postal Union.

Subscriptions and correspondence concerning business matters should be sent to Warwick & York, Inc., 19 W. Saratoga St., Baltimore, Md.

VOLUME V SEPTEMBER, 1914 NUMBER 7

EDITORIAL.

COLLEGE DEPARTMENTS OF EDUCATION.

A noteworthy feature of the expansion of college curricula in the past two or three decades is the growth of education as an academic study. From single chairs in "pedagogy" in a few isolated institutions thirty years ago the subject has developed until only the smallest colleges fail to provide some sort of instruction in education, while the larger institutions have their well-manned, well-equipped schools and colleges of education with laboratories, libraries, museums, work-shops, clinics, and school survey bureaus. But this expansion has not been without opposition from other departments, and in many institutions an attitude of more or less veiled hostility still persists. There have been many reasons for this hostility in the past, but perhaps the chief reason for its persistence is the ignorance of college faculties regarding the aims and efforts of educational workers, and especially of the modern experimental movement in education. If the endeavors of professional workers in education to establish educational procedure upon a more scientific basis and to work out and apply scales of educational measurement were more generally known

by instructors in other departments the attitude toward educational courses would be more friendly. One of the duties of the department of education, therefore, is to educate the faculty in regard to current problems in education and the methods now used in attacking these problems, and to enlist their sympathy and co-operation. This, it is true, is a difficult task with the older generation of college professors in whose thinking the traditions of the restricted college curriculum and the fallacies of formal discipline are deeply imbedded, but much can be done with the younger instructors now entering the field.

Another duty of college departments of education has been emphasized by Professor A. Monroe Stowe, of DePauw University, in a series of theses which he has recently formulated and sent to college teachers of education. Courses in education are chiefly designed for those who are preparing to teach. But the prospective teachers constitute only a small percentage of the total student body, and the other students need to know something about modern educational movements. The educational problems which now confront the public are of great social significance. College-bred men and women should be the leaders of the community in the solution of these problems. Their college training should afford them a background for the intelligent consideration of educational questions. Particularly should college graduates be conversant with the modern scientific and experimental tendencies in education, with the work in mental tests, and with the effort to discover the individual capacities of students and to adjust school work to their needs. The traditional college course, or further specialization in languages, history, mathematics, or science, does not convey the slightest inkling of these movements. Dr. Stowe urges the offering of educational courses "planned especially for students not intending to teach, and of such a character as to develop in these students a lasting interest in our public schools and other educational agencies." In other words, college departments of education should not restrict their attention to those students who are preparing to teach, but should endeavor to awaken the entire student body to the significance of current educational movements, and thus enable college graduates to take their rightful place as leaders of public sentiment in securing an efficient school administration.

J. C. B.

NOTES AND NEWS.

The Fourth International Congress on Home Education, which was to have been held in Philadelphia, September 22-29, has been postponed on account of the war in Europe.

In order to more adequately meet the increasing demand for college training in the technical aspects of education the University of Pennsylvania will expand its department of education into a School of Education, co-ordinate with the College of Arts and Science. The new school will have a dean and faculty of its own, will have entrance requirements similar to those of the College of Arts and Science, and will offer a four years' course leading to the degree of Bachelor of Science in Education. Candidates for the degree must complete sixty-four units of work (one hour per week for a year), of which four are to be in physical education, twenty-five in fundamental or content subjects, eight in technical educational subjects, fifteen in further specialization in either fundamental or educational subjects, and twelve are to be elected according to the taste and work of the student. The course will be adapted specifically to the preparation of high school, academy and normal school teachers, to the training of supervisors and superintendents of schools, and to the encouragement of graduate study in education. Dr. Frank P. Graves, professor of the history of education, has been appointed dean of the new school.

The New York University School of Pedagogy announces the establishment of a new department for the training of teachers of defective children. The need of special instruction for backward and defective children is generally recognized, and the department has been organized to meet the increasing demand for especially trained teachers in this line of work. The courses are arranged for the benefit of kindergarten or grade teachers who wish to prepare for appointment as teachers of ungraded classes in the public schools, or as teachers of defective or delinquent children in institutions, for supervisors, superintendents, probation officers and others who are interested in the administrative aspect of the training of defectives,

and for advanced students seeking research work in this field. The department has secured the co-operation of the city departments of child hygiene and correction, and specialists in various private and state institutions for the care and training of the feeble-minded. The work of the department is open to graduates of state normal and city training schools and to college students of junior standing, and the departmental certificate is given on completion of thirty university hours, or two years of university work. Among the courses announced are the anatomy and physiology of the child, educational hygiene, psychology of defectives, methods of teaching defectives, observation and practice, speech defects, and a study of intelligence of school children.

The School of Education of the University of Chicago has established a psychopathic laboratory for the diagnosis, treatment and training of mentally defective children. The laboratory maintains a public free dispensary two forenoons in the week, at which defective children between the ages of four and sixteen are received. The routine examination includes heredity and family history, anthropometric measurements, the Binet-Simon intelligence tests, the *Aussage* test, the Kent-Rosanoff Association test, and a complete medical examination. In connection with the laboratory a special class has been organized for the instruction and training of backward and mentally defective children. This class meets five days in the week from 9.30 to 2.00 and the number of children in it is limited to fifteen. The laboratory thus affords an excellent opportunity for both experimental and practical work in the treatment of defective children. Up to the present time 135 children have been examined. The director of the laboratory is Professor H. C. Stevens, Ph. D., M. D.

Funds have been raised for the establishment of an assistant professorship in secondary education at Harvard University.

Dr. Cliff Winfield Stone, director of the training department of the State Normal School, Farmville, Va., has been appointed director of the training school at the Iowa State Teachers' College, Cedar Falls, Ia. Dr. Stone succeeds Mr. Dick, who has been called to the presidency of the Kearney Normal School.

CURRENT PERIODICALS.

(In this section only such articles will be noticed as bear directly or indirectly upon the interests of this Journal.)

THE PSYCHOLOGICAL CLINIC. Vol. VI, No. 8, January, 1913. WILLIAM E. GRADY. *Age and Progress in a New York City School.* 209-221. Reports that over-age, as distinguished from retarded, pupils, are not an additional expense to school systems, though they are an economic loss. Points out the value to teachers and supervisors of age-progress sheets and of frequent analyses of conditions.

W. S. H. MORTON. *Retardation in Nebraska.* 222-228. Found that the least repetition in the schools of Ashland, Neb., occurred in the sixth grade, and the most in the second grade. Decries the lock-step system, and pleads for schools adjusted to the child.

CLARA HARRISON TOWN. *Language Development in Two Hundred and Eighty-five Idiots and Imbeciles.* 229-235. Ability to understand spoken words precedes ability to speak; ability to repeat words precedes ability to use them; language development is so high at seven years that intellectual limitations above that age will not prevent free and fluent use of language.

No. 9, February, 1913. ELMER E. JONES. *Individual Differences in School Children.* 241-251. Declares that group teaching is wrong, and prophesies that within the next decade will come the psycho-clinicist and a course of study modified to care for the individual child.

WILLIAM H. PYLE. *Mental and Physical Examination of School Children in Rural Districts.* 260-262. Advocates the appointment of a county officer to supervise such examinations.

LOUISE STEVENS BRYANT. *A Bibliography of Social Service.* 263-268. Especially adapted to meet the needs of the social worker in a psychological clinic.

Vol. VII, No. 1, March, 1913. W. FRANKLIN JONES. *The Vitality of Teaching.* 1-10. The vital force of teaching lies in motivation—the arousal of interest—with all of its nourishing and determining rootlets which education must identify, name and learn how to foster.

G. W. GAYLER. *Elimination from a Different Angle.* 11-16. A study of attendance in Canton, Ill., shows a large percentage of gain in the upper grades. This is due to definite attempts, begun early in the course, to prevent failures by giving individual help and by trial promotions, two-thirds of which are successful; to the fact that pupils of the sixth, seventh and eighth grades are carefully familiarized with the work of the high school, and to class talks and individual letters about the value of studies.

HERBERT F. CLARK. *Whistling At Work—A Crime?* 17-19. Claims that this is a manifestation of joyous satisfaction in work that ought to be cultivated instead of repressed. "Only at funerals do people walk on tiptoes and one can hear the clock tick."

No. 2, April, 1913. W. H. HECK. *A Second Study of Mental Fatigue in Relation to the Daily School Program.* 29-34. Twenty-five-minute tests, morning and afternoon, on 573 pupils of 16 schools in Lynchburg, Va., show that fatigue is almost negligible in a hygienic school environment.

FELIX ARNOLD. *Politics, Efficiency and Retardation.* 35-38. Discusses dangers lurking in schools whose boards "run things quietly and smoothly," in "misguided paternalism," and in hobbled superintendents.

G. W. GAYLER. *Vocational Training As a Preventative of Crime.* 39-46. Urges the disciplinary value of a vocational aim in school work, and declares that school and church must give more attention to guidance, control and moral training of adolescents.

No. 3, May, 1913. WILLIAM E. GRADY. *Curriculum Making.* 57-67. In the arrangement of a course of study a professional attitude based upon "authenticated social and psychological facts" is necessary. One-sided tendencies due to the enthusiasms of laymen and special supervisors should be carefully guarded against.

KATHERINE H. BREVARD. *Progress of Repeaters of the Class of 1912 of the Public Schools of Washington, D. C.* 68-83. Traces the progress of 1908 repeaters (58.8 per cent.) among the 3243 eighth-grade children in the class of 1912, and finds that the two chief causes of repetition are (1) illness or physical defect and (2) failure in studies. These two causes vary inversely: White, first to eighth grade, 41.04 per cent. to 10.61 per cent., first cause; 34.32 per cent. to 80.08 per cent., second cause. Colored, 54 per cent. to 10 per cent., first cause; 32 per cent. to 70 per cent., second cause.

No. 4, June, 1913. J. E. WALLACE WALLIN. *Re-averments Respecting Psycho-Clinical Norms and Scales of Development.* 89-96. Asserts that clinical psychologists must be specially trained for their specific tasks; that psycho-clinical norms can never be established by group tests, and that scales of development, even when standardized, will afford only a starting point for the skilled clinical psychologist.

LUELLA A. PALMER. *Some Reconstructive Movements Within the Kindergarten.* 97-107. Claims that education is a continuous process which demands complete development through actual experience with life conditions in each stage as the best preparation for the next stage. The child should be the center of the curriculum, and his health should be the first consideration.

WILLIAM E. GRADY. *Syllabus Making.* 108-113. Discusses purposes, contents and methods of checking results in the preparation of a good syllabus.

No. 5, October, 1913. ARTHUR HOLMES. *How a Psychological Clinic Can Help a Special Class.* 117-126. A detailed account of the examination, diagnosis and treatment of nine cases in a special class.

MARGARET OTIS. *The Binet Tests Applied to Delinquent Girls.* 127-134. Application of the Binet Tests to 172 delinquent girls in the New Jersey State Home for Girls showed 25 per cent. normal, 30 per cent. morons and 45 per cent. defective.

J. C. LEWIS, K. J. HOKE, J. B. WELLS AND G. M. WILSON. *Accuracy of Pupil Reporting.* 135-141. What degree of reliability can be attributed to pupils' reports on their own progress through the grades? In 176 cases 93 per cent. of the normal children answered correctly, but 65 per cent. of the retarded children answered incorrectly.

No. 6, November, 1913. WILLIAM E. GRADY. *Measuring Efficiency of Instruction.* 145-152. Emphasizes the need of scales of measurement for school accomplishments, and cites pertinent recommendations from the reports of McMurry and Courtis in the New York City school inquiry.

CHARLES KEEN TAYLOR. *A Little More "Truth About Tobacco."* 153-160. Challenges an article in *Harper's Weekly,* January, 1913, and advances statistical proof of the evil effects of nicotine.

ANNA JOHNSON. *Retarded Sixth Grade Pupils.* 161-165. The reasons for retardation were truancy, slow mental development, excessive cigarette smoking, lack of application to school work, vicious disposition and moving about of family. All but two of the 23 pupils studied were physically normal.

ALICE GROFF. *What Is Sanity?* 166-169. Defines a sane mind as one whose reasoning processes are free from inhibitions due to "feeling-bias, prejudice or *idee fixe.*" Education, as a preventive agency, is preferable to the Freudian remedial methods.

No. 7, December, 1913. LIGHTNER WITMER. *Children with Mental Defects Distinguished from Mentally Defective Children.* 173-181. The term "mentally defective" is unscientific and misleading. Many children have mental defects (and are therefore "mentally defective") who pass as normal, or are at least useful members of society. The expression "socially unfit" or "socially defective" would better indicate those whose mental defects are such as to incapacitate them for social usefulness.

R. H. SYLVESTER. *Clinical Psychology Adversely Criticised.* 182-188. The chief criticisms are that clinical psychology over-emphasizes mental tests; is too narrowly limited to diagnosis; is of little practical value; is based upon the wrong kind of psychology, and is trespassing on the field of medicine.

C. E. BENSON. *Some Thinking Processes of Grade Children.* 189-197. Simple tests of judgment given to elementary school children show lack of attention to the needs of individual pupils, poor grading, undue formality in arithmetic teaching, neglect of the motor aspects of development, and emphasize the need of tests to determine intellectual ability.

PUBLICATIONS RECEIVED.

(Notice in this section does not preclude a more extended review.)

BIRD THOMAS BALDWIN. *Physical Growth and School Progress.* Bulletin No. 581. Washington: Bureau of Education, 1914. Pp. 215.

This monograph constitutes a new departure in measurements of physical growth, and presents data the need of which has long been keenly felt. Many thousands of measurements have been recorded of the height and weight of school children, but all have been mass studies composed of single measurements of individual children. Thus the norms for different ages have been derived from studies of different children, and in no case has the physical development of the same group of children been followed through a series of years. The author of the present monograph has collected the measurements of 861 boys and 1063 girls from the Horace Mann School, in New York, the University of Chicago schools, and the Francis W. Parker School of Chicago. These measurements were taken yearly or half-yearly, and cover the period from the sixth to the eighteenth year. They include measurements of height, weight and lung capacity, and are presented in such detail in tables and curves that the records of individuals and groups can be traced without difficulty. The monograph also contains a discussion of the relation between physical growth and school standing, a detailed historical and statistical summary of work done on physical measurements, and an annotated bibliography of 24 pages. It is undoubtedly the most complete work of the sort in existence.

H. A. BROWN. *The Measurement of the Efficiency of Instruction in Reading.* Reprinted from the Elementary School Teacher, Vol. 14, No. 10, June, 1914. Pp. 477-490.

A study of silent reading with reference to the rate of reading, the quantity of reproduction and the quality of reproduction. A "reading unit" is adopted which is a function of these elements, and a child's reading efficiency is determined by multiplying the average of the quantity and quality by the rate.

WARNER BROWN. *Habit Interference in Sorting Cards.* University of California Publications in Psychology, Vol. I, No. 4, 1914. Pp. 269-321.

In regard to the relation between speed and capacity to learn, the author concludes that "the attainment of high speed in such work

as this depends on native endowment rather than on capacity for benefiting by practice. Persons who fail to make a relatively good showing at the beginning will not be apt to improve their relative positions, in spite of the fact that they improve rapidly." There was no conclusive evidence of sex difference.

WARNER BROWN. *The Judgment of Very Weak Sensory Stimuli, with Special Reference to the Absolute Threshold of Sensation for Common Salt.* University of California Publications in Psychology, Vol. I, No. 3, 1914. Pp. 199-268.

An important contribution to the psychology of judgment on taste stimuli. It is interesting to note that pure distilled water is not tasteless, but has a slightly bitter taste.

PAUL CARUS. *The Mechanistic Principle and the Non-Mechanical. An Inquiry Into Fundamentals, with Extracts from Representatives of Either Side.* Chicago: The Open Court Publishing Co., 1913. Pp. iv, 125.

This book contains a critical discussion of the principles of mechanism and teleology, a summary of Mark Twain's philosophy in What Is Man, a statement of La Mettrie's Man As a Machine, and extracts from Dr. W. B. Smith's article in *The Monist* (January, 1913), entitled Push or Pull, and from Dr. J. F. Bixby's The Open Secret. The author everywhere emphasizes his own position, which recognizes no conflict between the principle of mechanism and the responsibility and freedom of man.

PAUL CARUS. *Nietzsche and Other Exponents of Individualism.* Chicago: The Open Court Publishing Co., 1914. Pp. 150.

This attractive book, by the editor of *The Monist*, is a readable and helpful introduction to Nietzsche's philosophy. In it one may find some of the more significant facts of Nietzsche's personality and life; something of the ideal of the "overman," and not a little of Dr. Carus's own philosophy. The author regards Max Stirner (Johann Casper Schmidt) as the predecessor of Nietzsche's individualism—a conception of life based on a misunderstanding of the individual man and the significance of society for him. Of the adherents of Nietzsche's ideal—"Be thyself! Be unique! Be original!"—special mention is made of the Englishman George Moore, author of Confessions of a Young Man. Like his master, Moore is a disciple of Schopenhauer. As for the majority of Nietzsche's followers, they are among those "who rebel against the social, the political, the religious and even the scientific condition of our civilization." Pro-

fessional philosophers do not own Nietzsche. He is "a leader and a prophet, and as such he stands for the most extreme egoism."

ELLWOOD P. CUBBERLEY. *Rural Life and Education.* Boston: Houghton Mifflin Company, 1914. Pp. xiv, 367. $1.50 net.

An attempt to set forth the rural school problem in its relation to the social conditions of rural life and their historical development, and on this basis to make more precise and definite the needs of the rural schools. Of especial interest are the chapters on "A New Curriculum." "A New Teacher" and "A New Type of Supervision." Special courses for the training of rural teachers should be offered in rural high schools.

ALEXANDER DARROCH. *Education and the New Utilitarianism.* New York: Longmans, Green & Co., 1914. Pp. vii, 169. $1.20 net.

A collection of occasional addresses introduced by the usual apology that "they have been composed and written in the intervals of a busy practical life." One of the addresses deals with the question, "Is a Science of Education Possible?" After various observations in the vein that "a sound psychologist is not necessarily a good teacher," the question is answered to the effect that "we are not within sight of a scientific pedagogy."

GEORGE R. DAVIES. *A Statistical Study in the Influence of Environment.* Reprinted from the Quarterly Journal of the University of North Dakota, Vol. IV, No. 3, April, 1914. Pp. 212-236.

A study of the question, "Are noted men more likely to come from the crowded urban states, with their superior wealth and opportunities, than from sparsely-settled ones?" As sources of data were chosen "Who's Who in America," "Who's Who in Science" and "American Men of Science," and the question is answered in the affirmative.

MARCELLE DONTCHEF-DEZEUZE. *L'image et les reflexes conditionnels dans les travaux de Pavlow.* Paris: Librairie Felix Alcan, 1914. Pp. xvi, 176. Fr. 2.50.

An interesting study of the nature and functions of mental imagery on the basis of Pavlow's important investigations. The book gives what is perhaps the most detailed and coherent account of the work of Pavlow and his school that is available to the reader who is not a master of Russian. Emphasis is naturally laid on the physiological and reflex aspects of imagery.

JEROME DOWD. *The Nego Races: A Sociological Study. Vol. II, East Africans and South Africans.* New York: Neale Publishing Co., 1914. Pp. 310. $2.50 net.

A brief and condensed account of the topography of East Africa, of the inhabitants, their economic, family, political, religious, ceremonial and esthetic life, and their psychological characteristics. The extreme condensation makes the narrative somewhat dry and schematic, but the statements are clear and definite, and supported by numerous references to original sources.

Eighth Annual Report of the Carnegie Foundation for the Advancement of Teaching. New York: Published by the Foundation, October, 1913. Pp. vi, 158.

Part II of the report is devoted to current educational problems, in which the following subjects are discussed: The evolution of college entrance requirements; State regulation of higher education; Politics and education in Iowa; Improvements in the financial status of college teachers, and College catalogues.

Eugenics: Twelve University Lectures. New York: Dodd, Mead & Co., 1914. Pp. xiii, 348.

In the scholastic year of 1912-1913 Mrs. Huntington Wilson provided for a lecture on eugenics in each of 32 leading colleges and universities in the United States, and in the present volume a selection of 12 of these lectures is presented to a larger public. There is a foreword by Prof. Lewellys F. Barker, and the subject is considered from the points of view of the zoologist, the physician, the physiologist, the anatomist, the geneticist, the sociologist, the economist and the psychologist. Among the contributors well known to educational psychologists are Charles B. Davenport, W. H. Howell, Arthur Holmes, Charles A. Ellwood and Edward L. Thorndike. As a popular presentation of the outstanding positions of eugenics the volume is unequaled.

HENRY H. GODDARD. *The Research Department of the Training School at Vineland, N. J.* Publications of the Training School, No. 1, May, 1914.

This attractive monograph presents in clear, direct fashion what is being done and what is planned for the future in this foremost American laboratory for the study of feeble-mindedness. It is to be hoped that philanthropically-minded men will be impressed by the showing made, and will provide the research laboratory with an adequate endowment to carry on the work planned.

L. D. HARVEY. *Essentials of Arithmetic.* Book I, pp. 224, $0.25. Book II, pp. 507, $0.50. Cincinnati: The American Book Co., 1914.

Book I is intended for the second, third and fourth school years, Book II for the fifth, sixth, seventh and eighth years. The attempt is made to correlate the work in arithmetic with that in agriculture, commerce and manual training.

CHARLES HUGHES JOHNSTON, Editor. *The Modern High School.* New York: Charles Scribner's Sons, 1914. Pp. xviii, 847. $1.75.

The present volume, the complete title of which is "The Modern High School—Its Administration and Extension, with Examples and Interpretations of Significant Movements," continues the line of treatment initiated in the author's former book, "High School Education." Each topic is discussed by a specialist in the particular field, and unity is secured by the author's plan of the work and supervision of its execution. The previous volume dealt with the problems of classroom instruction in the different high-school subjects, the present one "contains those accounts and expert endorsements of high-school movements which are illustrating for us the only kind of social education which as yet can have definite meaning." Part I is concerned with the institutional relationships of the high school, and treats the high school as a social enterprise, as a legal institution, as a business undertaking, as a continuation of the elementary school, as a preparation for college and as a preparation for industrial life. Part II considers such specialized relationships as a socialized curriculum, class and home, supervised study in school and at home, and the co-operation of the school with other agencies in the community. Part III discusses the high school as a social group, the improvement of teachers in service, social activities, athletics, debating societies, journalism and fraternities. Part IV takes up the high school as a social center, continuation work, libraries, vocational guidance, hygiene, art, moral agencies and the religious life of the pupils.

WILLIAM A. MCKEEVER. *The Industrial Training of the Boy.* New York: The Macmillan Company, 1914. Pp. ix, 72. $0.50.

"It is the watchword of this volume that common work can be so related to the industrial worker everywhere that he may not only find exceeding great joy in his daily employment, but that he may continue to develop his personality in such ways as to make peace, contentment and spiritual poise predominating elements of his character."

GEORGE FOOT MOORE. *History of Religions.* New York: Charles Scribner's Sons, 1913. Pp. xiv, 637. $2.50 net.

An extremely important phase of the development of human civilization is the manifestation of the religious nature. Every psychologist and educator should be interested in the study of religious development. The present work outlines the religions of China, Japan, Egypt, Babylonia, Assyria, India, Persia, Greece and Rome. It is to be followed by a second volume devoted to Judaism, Christianity and Mohammedanism. The treatment is fair, open and unbiased, and is from the strictly historical point of view.

HUGO MUENSTERBERG. *Psychology and Social Sanity.* New York: Doubleday, Page & Co., 1914. Pp. xi, 320. $1.25 net.

In this entertaining book the well-known director of the Harvard Psychological Laboratory allows his critical fancy to play upon some of the foibles and weaknesses of American social life. Perhaps the most interesting chapter for the educationist is the one on sex education. In trenchant phrases he lays bare the psychological dangers in the present campaign for sex enlightenment, and urges upon thoughtful readers the only policy which contributes to purity and sanity of thought—the policy of silence. Other delightful essays are those on the intellectual underworld, the mind of the investor, and society and the dance.

MAUDE PARMLY. *First Reader.* Pp. 132. *Teachers' Manual.* Pp. 143. Cincinnati: The American Book Co., 1913.

We are almost moved to envy the youngsters the gorgeously illustrated reading books that are offered them nowadays. The manual presents many clever devices for interesting children in their reading.

ARTHUR C. PERRY AND GERTRUDE A. PRICE. *American History. Second Book.* Cincinnati: The American Book Co., 1914. Pp. 352. $0.60.

This book covers the history requirements for the sixth year. It is written in a simple, easy style, and is richly illustrated.

BERNARD PICK. *The Cabala: Its Influence on Judaism and Christianity.* Chicago: The Open Court Publishing Co., 1913. Pp. 109.

A brief sketch of "that system of philosophy, or, more properly, of Jewish theosophy, which played so important a part in the theological and exegetical literature of both Jews and Christians ever since the Middle Ages." The book closes with a bibliography of references for a more detailed study of the subject.

BERNARD PICK, PH.D., D.D. *Jesus in the Talmud. His Personality, His Disciples and His Sayings.* Chicago: The Open Court Publishing Co., 1913. Pp. 100.

An interesting discussion of the relation of the Talmud and the New Testament, with the conclusion that "the Gospel of Jesus remains an altogether new thing and the Spirit life that He awakened is still diametrically opposed, in many respects, to the religious life that the Talmud fosters."

ADA M. SKINNER. *Dramatic Stories for Reading and Acting.* Cincinnati: The American Book Co., 1914. Pp. 224. $0.35.

Doubtless the methods of the schools lay undue emphasis on oral reading to the neglect of silent reading, but in so far as oral reading is taught, much greater attention should be paid to the dramatic element. This supplementary reader for the third and fourth years will furnish useful material for this purpose.

HENRY PRESERVED SMITH. *The Religion of Israel.* New York: Charles Scribner's Sons, 1914. Pp. x, 369. $2.50 net.

This book is "an endeavor to give an intelligent account of the rise and progress of Israel's religion from its beginnings in the nomadic period down to the tragic event which put an end to the Jewish state. The reader who is even superficially acquainted with the progress of Biblical study during the last 40 years will not be surprised to find that the book proceeds upon the supposition that the results of the so-called higher criticism are fairly certain." The book is a masterpiece of historical exposition.

WILLIAM STERN. *Zur vergleichenden Jugendkunde der Geschlechter.* Reprinted from Bund für Schulreform. Dritter Deutsche Kongress für Jugendbildung und Jugendkunde, 1914. Pp. 17-38.

The author presents the evidence for differences between the sexes from early childhood through adolescence. Little difference is found in degree of intelligence or ability, or in the mastery of special subjects, but much emphasis is laid on differences in manner of attacking problems and situations. Much of the evidence that the author cites on this point is of doubtful validity, and needs further confirmation.

EDWARD L. THORNDIKE. *Educational Psychology, Volume III. Mental Work and Fatigue and Individual Differences and Their Causes.* New York: Teachers College, 1914. Pp. x, 408.

This volume concludes the survey of the field of educational psychology, in which the author has rendered a signal service to students

of the subject and to the cause of educational science. One of the conspicuous features of this service is the clear indication of the tremendous amount of experimental work that remains to be done in almost every branch of the inquiry. Every chapter of the three volumes bristles with problems that call for further investigation. Great credit is due the author for sifting the mass of data that has accumulated during the past two decades, pointing out many of the fallacies that have crept into the interpretation of that data, and bringing up with a sharp turn those educational theorists whose salient characteristic would seem to be vivid imagination rather than scientific caution. The present volume gives an authoritative resume of recent work in fatigue and mental work, and contains a revision of the author's original volume on educational psychology, published in 1903, and revised in 1910, now more appropriately entitled the psychology of individual differences.

J. E. Wallace Wallin. *The Mental Health of the School Child.* New Haven: Yale University Press, 1914. Pp. xiii, 463. $2.00 net.

The sub-title of this book is "The Psycho-Educational Clinic in Relation to Child Welfare. Contributions to a New Science of Orthophrenics and Orthosomatics." It is a collection of papers and addresses most of which have already appeared in various technical journals, and which are here brought together and revised so as to give a continuous presentation of the author's ideas and experiences as a psycho-clinicist. The first five chapters deal with the nature and functions of clinical psychology, chapters six to eleven with the use of the Binet-Simon scale and other measures of mental efficiency, and chapters twelve to nineteen to mental and physical hygiene. In view of the growing interest in psycho-clinical studies, the book will doubtless have a wide circulation.

Florence Elizabeth Ward. *The Montessori Method and the American School.* New York: The Macmillan Company, 1914. Pp. xvi, 243. $1.25.

This little volume contains the substance of a series of talks and discussions with classes after the return of the author from a visit to Rome and a firsthand study of Madam Montessori's work. It therefore has a certain personal touch that is lacking in many of the current commentaries. In another respect the book is to be commended. The tone is frank and open, the attitude is that of seeking for the best wherever it may be found, and an attempt is made to compare the Montessori principles with the most approved tenets in American theory and practice.

E. W. Weaver. *Vocations for Girls.* New York: The A. S. Barnes Company, 1913. Pp. 200. $0.75 net.

In most of our discussions of vocational guidance we have the interests of boys chiefly at heart. It is well that we should have this timely little book to call our attention to the needs of the girls. The author has endeavored to summarize the conditions of admission to gainful occupations for women, and to present in suggestive form the methods by which workers may advance themselves.

Michael West. *Education and Psychology.* New York: Longmans, Green & Co., 1914. Pp. viii, 341. $1.50 net.

This is one of those fast-disappearing books on educational psychology, or psychology for teachers, written out of the author's own inner consciousness. He presents it as a textbook for schools and training colleges (what soup do the poor teachers-in-training not get dished up to them!), but admits that it is also intended for a larger public. The author has evidently thought a great deal on the subjects of which he writes, and has some rather clever observations on practical school situations—but of modern psychology not a whit.

John Wesley Young. *Lectures on the Fundamental Concepts of Algebra and Geometry.* New York: The Macmillan Co., 1911. Pp. vii, 247. $1.60 net.

It is a general impression that of all the sciences mathematics is the one in which the data and principles are fixed and definite,—in which the subject matter undergoes no change. Any mathematician, however, is well aware that in no field of learning have the bounds been so tremendously widened in the last few decades as in mathematics. Higher mathematics of the present day represents a new discovery. To set forth the developments of mathematics in such simple terms that they can be comprehended by anyone who has an elementary knowledge of algebra and geometry is the task which the author sets himself, and inspection of the book shows that he has acquitted himself well. It is a book that should be carefully studied by every high school teacher of mathematics.